THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXVIII. No. 707.] LONDON, NOVEMBER 28, 1876. [28TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—12,000 cubic feet of gas per ton of coal; 28-candle gas; coke 66·70 per cent.; volatile matters 33·30 per cent. Coke of good quality.

RAMSAY'S PATENT CONDENSED GARESFIELD COKE.

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GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.

Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne.

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GENUINE TORBAY PAINT
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SPECIAL GASOMETER PAINT
(Mixed ready for use).

These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

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JOSEPH COWEN and CO.,
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FIRST-CLASS MATERIALS & WORKMANSHIP;
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And Gas Apparatus of every Description.
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ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonize a large amount of coal with a small per cent. of fuel.

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FOR THE ENGLISH GOVERNMENT
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Presented by Her Majesty's Government to the French Government,
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Warranted to Measure correctly & not to vary.

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WROUGHT-IRON TUBES AND FITTINGS

AND

LAP-WELDED IRON AND HOMOGENEOUS METAL BOILER TUBES.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools.

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HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
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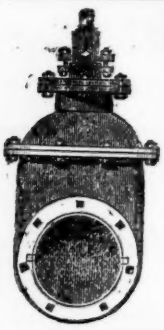

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These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

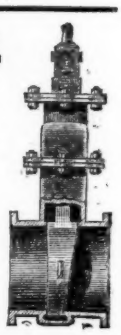
They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.



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The only Prize Medal awarded for TUBES & FITTINGS.

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AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

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CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

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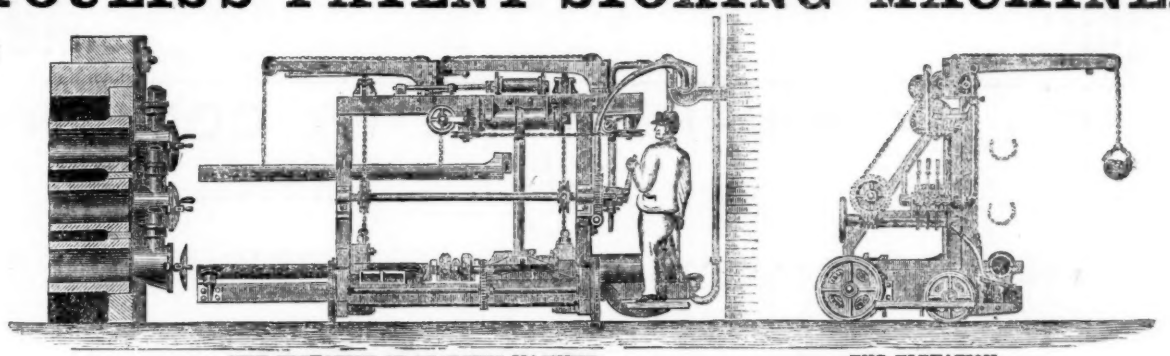
FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF CHARGING MACHINE. END ELEVATION

(*The Drawing Machine will be Illustrated in next week's Advertisement.*)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz:

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THE ORIGINAL

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NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

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Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

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IMPERIAL METER COMPANY,

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KING'S ROAD, LONDON, N.W.,

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MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

HODGE & CO.'S

IMPROVED VENTILATING SUN-LIGHTS

WITH TALC REFLECTORS AND SELF-ACTING VALVES TO PREVENT DOWN-DRAUGHT;

VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.

Ormolu, Bronze, & Crystal Gaseliers;

MEDIÆVAL CHURCH WORK AND CORONÆ

COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;

COLUMNS, BRACKETS, & STREET LANTERNS;

BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.

GAS ENGINEERS,

100, HATTON GARDEN, LONDON.

Drawings and Prices upon application.

JOHN WRIGHT AND CO., ESSEX WORKS, BIRMINGHAM,

Beg to call the attention of MANAGERS and DIRECTORS of GAS COMPANIES to the following letter which they have lately received.

COPY OF LETTER RECEIVED FROM MAGNUS OHREN, Esq.

Crystal Palace District Gas Company, Lower Sydenham, S.E.

To Messrs. John Wright and Co., Essex Works, Birmingham.

Dear Sirs,—In reply to your inquiries, I am glad to state that the use of GAS COOKING AND HEATING STOVES has been a complete success here. We have several hundred in use in our districts. We also find it advantageous to let out Stoves at a small rental. We have now 275 Stoves at rent.

The Stoves you make I can with confidence recommend, having so many in use, and giving satisfaction. I need scarcely point out to you the advantage to Gas Companies to recommend the use of Gas Stoves to their Gas Consumers, even where they do not supply them on sale or rent, as the use of Gas Stoves brings day consumption, and thus the Company make a profit by day as well as by night.—I am, dear sirs, yours faithfully, MAGNUS OHREN.

Size, 25½ in. high; 14 in. wide; 12½ in. back to front.

Price 50s., complete with Pan and Gridiron.

GAS HEATING STOVES

(TERRA COTTA AND IRON).

THE CHEERFUL STOVE.

COOKING STOVES.

BREAKFAST COOKERS.

BATHS HEATED by GAS

GAS STOVES

For Boiling, Broiling, Preserving, Heating Flat Irons, and for all other Domestic Purposes.

Gas Companies and the Trade who have not our Illustrated Catalogue are respectfully requested to apply for same.

A LIBERAL DISCOUNT to the TRADE.

No. 4003.

THE CHEERFUL GAS STOVE, with Copper Reflector,

Has all the appearance of a Bright Fire.

PRICE from 32s.

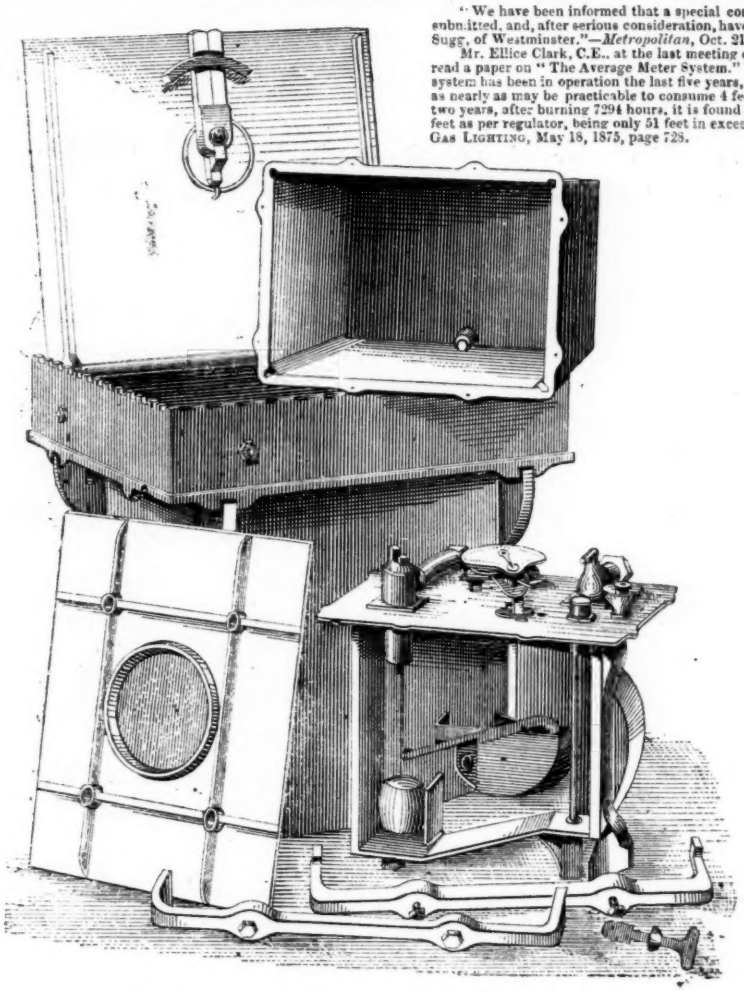
PUBLIC LIGHTING ON THE AVERAGE METER SYSTEM.

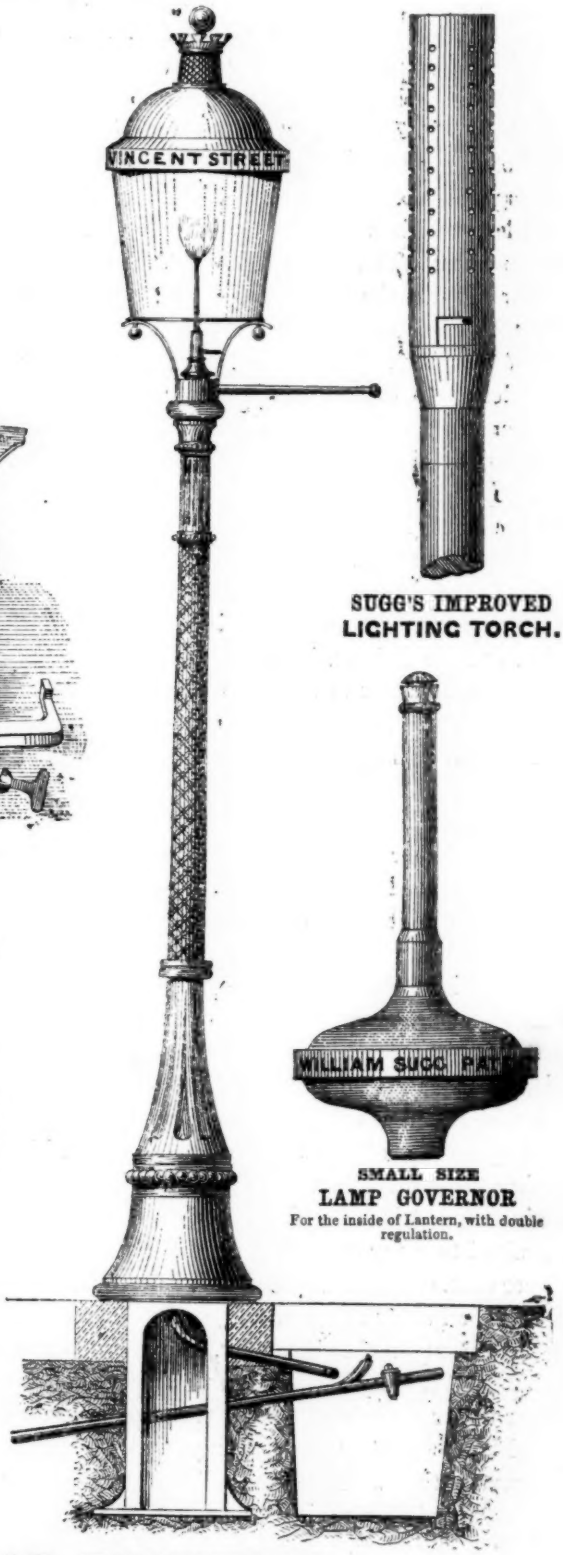
PATENT PUBLIC LAMP METERS,

AS NOW ADOPTED BY THE PARISH OF ST. MARY ABBOTTS, KENSINGTON.

"We have been informed that a special committee made a most exhaustive examination of the sample meters submitted, and, after serious consideration, have selected the new Patent Public Lamp Meter, invented by Mr. William Sugg, of Westminster."—*Metropolitan*, Oct. 21, 1876.

Mr. Ellice Clark, C.E., at the last meeting of the Association of Municipal and Sanitary Engineers and Surveyors, read a paper on "The Average Meter System." Referring to Folkestone, he said that "The Average Meter Indicator system has been in operation the last five years, and found to act well. Sugg's Self-Acting Regulator is used, adjusted as nearly as may be practicable to consume 4 feet per hour, and so very satisfactory is this apparatus that, for the last two years, after burning 7294 hours, it is found by the Average Meter to have consumed 29,227 feet, as against 29,176 feet as per regulator, being only 51 feet in excess of that which the apparatus is adjusted to consume."—JOURNAL OF GAS LIGHTING, May 18, 1875, page 728.





SUGG'S IMPROVED
LIGHTING TORCH.

SMALL SIZE
LAMP GOVERNOR
For the inside of Lantern, with double regulation.

WILLIAM SUGG'S
IMPROVED PATENT LAMP METER,

With adjustable Lid to suit the Slope of any Pavement.

Can be easily cleaned and repaired by any ordinary workman. Improved index and patent flexible joints. The inlet service and the connexion to stand-pipe can be cleaned out without opening the ground; the lid covers both of these. Clear glass plate on internal lid.

SUGG'S IMPROVED
LAMP COLUMN & LANTERN,

AND THE METHOD OF FIXING THE AVERAGE METER.

NOTE.—This kind of Meter was originally invented by William Sugg, in conjunction with Mr. Thomas Hawksley, Past-President of the Institute of Civil Engineers. They were first used at Nottingham in 1865, and are still at work. The Gaslight Company and the Corporation were both quite satisfied with the results. They were also introduced at Folkestone in 1869 by the late Mr. T. G. Barlow, Editor of the JOURNAL OF GAS LIGHTING. The success of the system put an end to a very long and troublesome dispute between the gas company and the local authorities. They are still at work with the same satisfactory results. They have since been used in several important towns, with equally good results.

No other kind of Lamp Meter has ever achieved so complete a success.

WILLIAM SUGG'S
PATENT PUBLIC LAMP GOVERNOR,

With Steatite Incorrodible Burners.

Guaranteed to give the greatest amount of light for the quantity of gas consumed. Nearly a Million of these, and those of William Sugg's later inventions, are in use in various parts of the globe.

MODERN STREET LIGHTING.

BY WILLIAM SUGG, A.I.C.E.

Price 1s. 6d.

LIGHTING TABLE.

Diagram showing the Curves of Sunset and Sunrise throughout the Year.

Price 2s. 6d., Litho.

WILLIAM SUGG, GAS ENGINEER,
VINCENT WORKS, VINCENT STREET, WESTMINSTER.

TO THE

ENGINEERS & MANAGERS OF GAS-WORKS.

GENTLEMEN, *Nov.* 21, 1876.

The advantages of the WARNER & COWAN METER may be briefly stated. They are—

Practical accuracy of measurement under every condition of water-line.

A greater range of water-line, by which the Meter is less sensitive in its float action; therefore less liable to be affected by sudden increase of pressure, and external causes, with a low water-line.

Simplicity of action, and also of construction for repairs.

These positive advantages, thus briefly enumerated, do not fairly place the great advantages of this Meter before the purchaser, therefore justice cannot thus be rendered to the Meter. The great advantages can only be seen when this Meter is placed in comparison with those constructed upon other principles, which we will now briefly do:—*First*, with the Common Wet Meter; *second*, with the Compensating Wet Meter; *third*, with the Dry Meter (so called).

First, then, the COMMON *Wet* Meter varies in measurement with every variation of the water-line to the extent of 5 per cent. (2 per cent. against the consumer, and 3 per cent. against the Company, as per Sales of Gas Act). This being the least necessary amount for the practical working of the float; but it is not sufficient to ensure efficiency of action under the varying demands of gas supply; hence the many arrangements for protecting the float from the action of the gas. The WARNER & COWAN Meter is unaffected by change of water-line in its measurement, therefore has a longer range of float, hence is less sensitive and more stable in action. The larger sizes are made with floats too, which the Common Wet Meter cannot have (and so are exempt by Act of Parliament). Thus the Companies are entirely dependent upon their inspectors for the due measurement of the gas by these very important instruments, the large Meters.

The COMPENSATING *Meter* has the same form of measure (the common wheel) as the ordinary Wet Meter, but the makers, knowing the defects of it, have endeavoured to remedy them by the assistance of various contrivances to maintain a constant water-line. Messrs. WARNER & COWAN have dealt with the measure itself; the wheel is altered in construction to make it an unvarying measure, but in action the Meter is as simple as the most simple of Common Wet Meters, and can be repaired as easily as one of them.

The DRY *Meter* is really NO METER at all; it is an aëriform engine, and only to the extent of the number of the revolutions made by the engine being recorded by an index, can it be considered a measure. The diaphragms, as they are called, are two double bellows coupled together, and actuating through the intervention of rods and cranks, the valves necessary for changing the current of gas to and from the bellows in its way through the engine. It will be seen at once, that in considering the Dry (so called) Meter thus, that the principle of construction is wrong, and no amount of ingenuity expended in arrangement or care in manufacture can convert a pair of bellows into an absolute positive unvarying measure. The leather stiffens in some cases, and so the bellows or diaphragms do not become fully inflated, hence the action is against the consumer; in other cases the leather becomes more flexible, the indications then are against the Company; further, in most cases the porosity of the leather is such that small quantities of gas are allowed to pass without any movement of the engine. The valves, too, are another source of weakness; by wear and by the deposit of oil and other matter on the faces, the action of the instrument is affected. Thus it will be seen that while the Common Wet Meter varies, its variation is limited to 5 per cent., but that the variation of the Dry (so called) Meter is unlimited, and may vary 50 per cent. or more. Instead of it being "a remedy" then "for all the defects of the Wet Meter," it cannot be relied on at all as a measure, and its complicated mechanism is such, that while a considerable expense is thrown upon the Company, the consumers are annoyed by the frequent changes required. The WARNER & COWAN Meter, then, is the only simple, stable, efficient, unvarying, and perfectly reliable Meter under every change and variation of the gas supply.

Makers of Dry Meters only will, no doubt, object to the above remarks, but cannot successfully controvert them. Those who, like ourselves, make both Wet and Dry Meters are better able to state the facts, and our position, as one of the largest manufacturers of Dry Meters, will protect us from any charge of prejudice.

Gentlemen, yours respectfully,

London and Edinburgh. **W. & B. COWAN.**

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

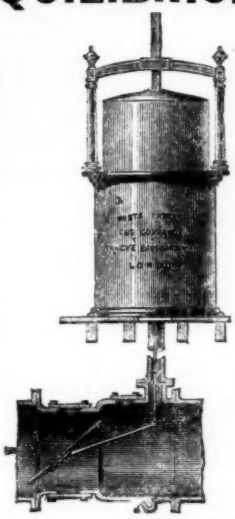
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

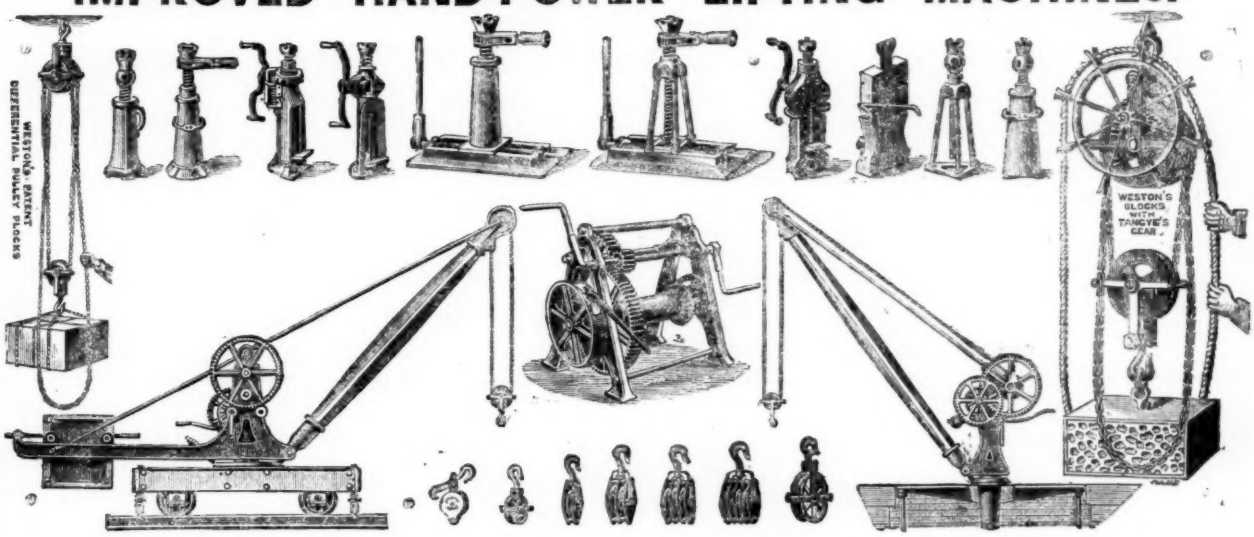
MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,

(Signed) JOHN JOHNSON.

IMPROVED HAND-POWER LIFTING MACHINES.



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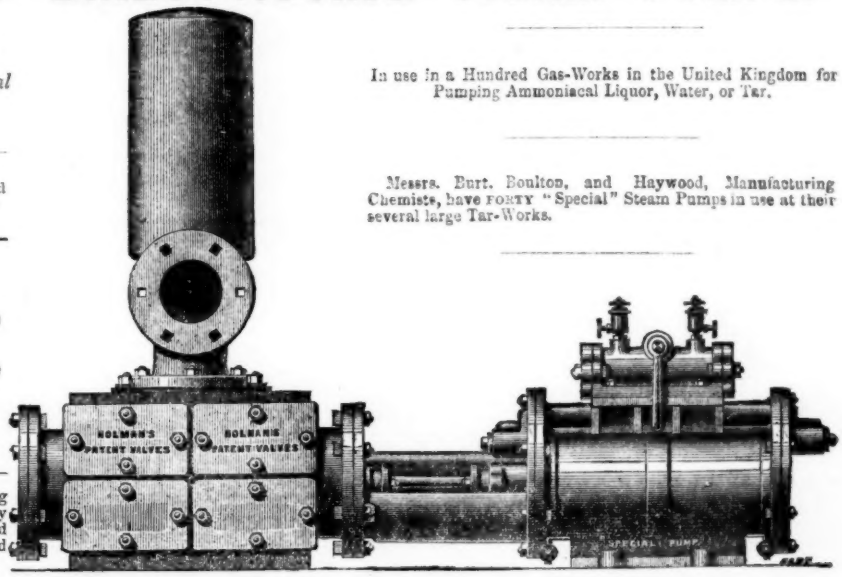
3	1½	9	450	£16
4*	2	9	815	18
3	3	9	1,830	18
5	2½	12	1,250	21
5*	3	12	1,830	22 10
4	4	12	3,250	25
6*	4	12	3,250	30
5	5	12	5,070	32 10
7*	5	12	5,070	40
6	6	12	7,330	40
8*	6	12	7,330	50
7	7	12	9,750	50
10*	7	12	9,750	65

* These sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance piece between steam and pump cylinder at a small extra cost.



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6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
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Are upheld for five years without charge.

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METERS FOR MEASURING WATER.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

COMMUNICATIONS RECEIVED.—"*An Ex-Secretary of forty years experience.*" "*W. T. van Duesburgh.*"

I. B. H.—*The difference in the cost would be that of the additional quantity of cannel required to produce gas of higher illuminating power, added to the cost of the firing material, and allowing for the diminished value of residuals.*

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, NOVEMBER 28, 1876.

Circular to Gas Companies.

THE Gaslight and Coke (Chartered) Company have given Notice of a Bill they intend to promote in the next session of Parliament, which will bring the Company and consumers face to face on the sulphur question. We have before remarked on the change of opinion which has come over the local authorities of the Metropolis since they proposed to become gas makers. Sulphur in gas, as many of our columns have told, was at no distant date deemed by them an unmitigated, and even dangerous, nuisance. It was regarded as destructive to property and detrimental to health, and, at the bidding of the authorities, the companies have been compelled to remove all that was considered possible, no matter what cost the operation might entail. When, however, the two metropolitan authorities promoted Bills to purchase the companies undertakings, or to start competing works, nothing like a limitation of the amount of sulphur permissible in the gas was proposed in the measure. The matter was allowed quietly to drop out of notice, and it is only fair to say that a sulphur agitation has never been revived. More than that, a certain tolerance is observable. Following well-known guides, deserving of every consideration, it is argued that the gas companies ought not to be put to great expense—an expense which adds considerably to the cost of production—in order to remove but a small fraction of the sulphur contained in the original gas. Say that the crude gas contained only thirty grains of sulphur in other forms than that of sulphuretted hydrogen, and that the Instructions of the Referees allowed twenty-five to remain, is it not absurd to put a gas company to an enormous expense to remove that excess of five grains? When the question is put in this way, all are agreed, and we shall not notice the obvious objections to this line of argument.

But to return. The Notice of the Company is for an Act to "alter, amend, extend, or enlarge, and, if need be, to repeal wholly, "or in part, sections 30 and 51 of the Company's Act of this year." The first-named of these sections gives the Referees power to fix the maximum amount of impurity to be allowed in gas, regard being had to the situation of the works, and the possibility of a nuisance being occasioned by the process of purification. Section 51 renders the Company liable to a fine if the amount of impurity allowed by the Referees is exceeded.

Section 30 allows a very wide discretion to the Referees, and their position up to the present time has been rather a difficult one. On the one hand, they (we speak of former occupants of the post) were strongly pressed by the authorities to fix a low sulphur maximum, while the companies urged that sulphur could not be removed without occasioning a nuisance. In the endeavour to carry out the Instructions of the Referees, a serious nuisance, it is alleged, has been occasioned at the Haggerston works of the Chartered Company. We say nothing of Fulham, because we do not remember the day when there were not complaints of that station. They began originally, we have been told, when the late Imperial Company refused to subscribe to a certain clergyman's schools in the neighbourhood, and they have been continued, at intervals, by various parties ever since.

Without speculating on the origin or cause for these complaints, we may remark that they come very opportunely for the Company, having regard to the promotion of this Bill, which is intended to abolish the functions of the Referees, so far as they are now empowered to fix a limit of impurity, and to define with greater precision the degree of purity of the gas supplied by the Company. It will be sought, also, to relieve the Company from all liability to penalties, when carrying out the Instructions of the Referees. At the present moment it is a question who are responsible for the nuisances at Haggerston and Fulham—the Gas Company or the Referees. Proceedings have been threatened to determine the point, but now that Notice of this Bill has been given, we do not expect to hear more of them. When we see the Bill, and know the actual provisions it is desired to enact, we shall be better able to judge of the merits of the measure. If it were to abolish the office of Referees altogether, we should better understand the matter; but to leave them with limited functions, at a heavy cost to the companies, does not look reasonable.

In the tenth report of the Warden of the Standards, just issued, the mode of testing the illuminating power of gas is referred to. Unlike all other instruments the Warden has to deal with, the photometer in use cannot be considered to be scientifically accurate. The principle is accurate enough (we say this with the information that a paper will shortly be, or has already been, presented to the Royal Society, upsetting the theory on which it is founded); but in practical use, several sources of error, vitiating the results, are introduced. We shall not allude further to these, until we place the text of the full report before our readers; but we may express, at once, a perfect agreement with the Warden, when he says: "Although we can "hardly look forward to obtaining scientifically accurate results, "we might, at least, secure a uniform mode of testing the quality "of gas throughout the country." This result is, in fact, being secured by the steady operation of the Gas-Works Clauses Act, 1871, which, however, leaves a choice of photometers. The relative advantages of the different photometers in actual use, we cannot here discuss. The Warden of the Standards may refer to them in some future report. Here we will only repeat a wish, that there may be, at no distant day, one quality of gas and one standard photometer in use from Land's End to John-o'-Groats.

With a steadily increasing gas business, the Corporation of Salford, as will be seen by the abstract of the accounts we publish elsewhere, are at present unable to make any surplus profit. The misfortunes of past management still cling to the undertaking; but the committee express a hope, which we believe to be well founded, that, under the guidance of their new manager, the works will, as soon as possible, be put into such a condition, and the undertaking will be so conducted, that in course of time, the success in Salford will rival that of the gas undertaking on the other side of the Irwell. The contrast is, at present, remarkable; but the vitality of the Salford undertaking, as shown in the accounts as we publish them to-day, is so strong, that it is certain that careful management alone is necessary to place the concern in a most satisfactory state. We refrain from making any invidious comparisons, and will only remark now, that, in our opinion, there is no reason why the Salford should not be as successful as any corporate undertaking in the kingdom,

always excepting the one on the opposite side of the Irwell. The new manager has a splendid field to work in, and we believe he will be found fully equal to the duties of his position. We shall presently have a full statement of the accounts, and then, perhaps, may have a few more remarks to offer.

While on corporate gas management, we may notice that strange accounts come from Wigan, of the quality of the gas supplied by the Corporation of that borough. We feel bound to regard most of these complaints as exaggerations, if not calumnies. It is impossible to believe that only ten or twelve candle gas is supplied in the centre of the English cannel-field. More likely is it that rich gas is furnished, for the consumption of which improper burners are employed. In any case, it is worth the while of the Gas Committee of the Corporation to investigate the matter, and to endeavour to put things on a better footing. It seems very unlikely that they will be able to make a profit while so much dissatisfaction exists; for it stands in the way of the extension of consumption, on which the Corporation must depend for future profits. A ready answer can, we have little doubt, be given to the complainants, and it should be offered at once. Neither Corporations nor Gas Companies can afford to despise even unjust accusations.

The Corporation of Macclesfield have had a tolerably successful year's working. The net profits of their gas undertaking, for the year ending June 30, amounted to £3353, which they have carried to the extensions account, but which barely pays for the extensions made during the year. We may express a sincere hope, that further extensions of the gas-works will soon be required in Macclesfield. It will mean much more than additional profits to a gas undertaking.

The Horncastle Gas Act passed last session provided for the transfer of the undertaking of the Horncastle Gas Company, on the terms usually accorded to non-statutory companies—viz., 16¾ years purchase of the divisible profits. The Act also provided, that any matters in dispute should be referred to the arbitration of Messrs. Spice and Stevenson. On the part of the Company a claim was made for £25,033, while a valuation made for the Local Board amounted to £9768. The Board offered £12,000, which was refused by the Company, so the case went to arbitration as provided. We publish the first day's proceedings in another column, and here shall anticipate so far as to mention, that in the end the arbitrators could not agree, and that the case was left for the decision of the umpire, Mr. A. Penny. His award was taken up by the Local Board on Friday last, when it was found that the sum awarded amounted to £13,668 14s. 6d. The Company claimed to have made a profit of £1341 in 1875; but the award seems to be based on an estimated profit of about £850. The difference is considerable.

Gas and water affairs at Ramsgate will give rise to a very important contest in the next session of Parliament. The two companies have given notice of Bills to obtain further powers, and the Local Board have given notice of a Bill to effect a compulsory purchase of the two undertakings. We rather think that the decision of the Commons Committee of last session makes the Water Company secure, inasmuch as the Company are doing exactly what the Committee recommended they should do. The Gas Company we may consider as equally safe, unless the Committee appointed be imbued with fanatical notions as to the duties and claims of local authorities. Nothing can be alleged against the Isle of Thanet Gas Company, and the Local Board make no pretence of being able to supply gas better or cheaper. The object of the Board is simply confiscation. There would seem to exist some doubt whether the ratepayers, who have had to pay a sixpenny rate for the expenses incurred by the Board last session, will now support the authorities in their aggressive designs, and the Rev. E. Gripper Banks, who leads the opposition to the Companies, has thought it advisable to issue a circular, with a view, as he says, "to rouse the whole town to "support the Local Board in their most necessary contest." To stimulate the depressed feelings of the ratepayers, he represents that the Board, having promoted one Bill, the expenses of promoting another will be little more than the "House fees" and costs of advertising! His Parliamentary Agents will teach him better presently. It would take up too much of our space to refer to the circular at any length, and expose all the fallacies it contains. We may agree with Mr. Banks in one statement, which is to the effect that if the Board succeed, they will be authorized to pay all the expenses out of the money they will be empowered to borrow; but we do not believe that the Board will be allowed a period of ninety years for the repayment of the borrowed money. The Local Government Board will see to that; and if the Ramsgate authorities are allowed thirty years, it is as much as they can reasonably expect. This is, however, a matter of very little consequence if the Board succeed. But we do object to the misrepresentations made as to the costs if the Board fail. No one knows better than Mr. Banks, that House fees and advertising charges do not represent all the costs which will be incurred. Counsel have to be engaged, witnesses must be secured, and the inquiry next session must be longer than that in the last. Hence if the Board fail, a shilling rate is much more likely to be required than the penny in the pound suggested by Mr. Banks. The ratepayers of Ramsgate should look to this, and further consider whether there is any reasonable probability that they will be better off if supplied by the Board than they are now (or will be if the Water Company's Bill should pass) under the companies.

We mentioned, a week or two ago, that the Corporation of Warrington had called in Mr. R. P. Spice to advise them as to the value of the gas undertaking. It will be remembered that when the Corporation made overtures to purchase, the Company at once made a definite offer to sell on the usual terms —twenty-five years purchase of maximum dividends—which, at £7000 per annum, made a gross sum of £175,000, stipulating for no consideration for prospective increase of profits. This offer the Corporation gladly accepted; but, of course, objectors turned up within and without the Town Council. To silence these, Mr. Spice was called in, and his report confirms what we have always said, that the Corporation have an exceptionally good bargain in purchasing the undertaking at the Company's valuation. The known character of the directors, and the reputation of their manager, Mr. Paterson, was a guarantee for the accuracy of the accounts and the condition of the works. The latter, it seems, are practically new, and after an inspection of works, plant, and accounts, Mr. Spice reports that the undertaking is really worth more than the value set upon it. He estimates that the first year's operations will bring to the Corporation a net profit of £1380. The past experience of the Company shows that an annual increase of consumption at the rate of nearly ten per cent. may be calculated upon. Regretting, as we always do, the transfer of undertakings to municipalities, we may, in this case, congratulate the Corporation and ratepayers of Warrington, who are, we consider, deeply indebted to the Gas Company for their liberality and forbearance.

GAS LEGISLATION IN 1876.

(*Continued from page 731.*)

The following ten Acts confer extended powers on gas companies already incorporated:—

The *Bristol United Gas Act* is simply to empower the company to take additional lands for extensions of the works.

The *British Gaslight Company* (*Hull Station*) *Act* authorizes the British Company to expend on their Hull undertaking, out of their capital stock, a further sum of £80,000; also £20,000 to be raised by borrowing. The dividend on the additional capital is not to exceed six or seven per cent., according as it is raised. The gas supplied from the station is for the future to have the illuminating power of fourteen candles, and is not to contain more than thirty grains of sulphur or five grains of ammonia in one hundred cubic feet. The Act authorizes the purchase of additional lands, and extends the limits of supply.

The *Colney Hatch Gas Act* recites that by the Colney Hatch Gas Company's Act, 1866, the company were empowered to raise additional capital to the amount of £60,000, and to borrow £15,000 in respect thereof. It was, however, provided that no money could be borrowed until the whole of the capital had been issued and subscribed, and one-half paid. It appears that the company have not issued more than £34,510 of the capital authorized by the Act of 1866, and consequently no money has been borrowed. This Act of 1876 authorizes the issue of the balance of capital as preference shares, and further empowers the company to raise more capital to the extent of £20,000. The share capital of the company will, therefore, be £95,000, and this Act gives power to borrow a total sum of £20,300 in respect of it. The maximum dividends on all the new capital are limited to the rates usually allowed, but the Act contains some peculiar provisions with regard to dividends. In 1874 a disastrous explosion of gas manufactured by the company occurred at New Southgate, by which some cottages were wrecked and three lives lost. The accident cost the company £3220, which they paid out of capital. The Act we are now noticing, authorizes the repayment of this sum out of divisible profits, under restrictions as follows:—The maximum price for gas allowed by the Act is 6s. per 1000 feet, but so long as that sum is charged the company can only divide five per cent. on any class of ordinary shares. When 5s. 9d. is charged, the dividend may be six per cent.; with gas at 5s. 6d. per 1000, eight per cent. may be divided, and so on. But until the whole of that £3220 has been returned to capital account out of profits, the company cannot divide more than seven per cent. Since only the original capital of £15,000 is entitled to more than seven per cent. it would appear that the holders of original shares are to bear all the costs of the accident. As soon as the sum mentioned has been made good, and the price of gas has been

reduced to 5s. per 1000 feet, the profits divisible by the company will be ten per cent. on the original capital of £15,000, and seven or six per cent. on all the rest. Gas of fourteen-candle power, tested according to the provisions of the Gas-Works Clauses Act, 1871, is to be supplied at the usual pressures.

The *Derby Gas Act* empowers the Derby Gaslight and Coke Company to raise additional capital to the amount of £140,000, and to borrow £35,000 in respect thereof. The dividends on the new capital are limited as usual. The company are now required to supply fourteen-candle gas, tested by Sugg's "London" Argand, No. 1, and they must provide a testing-place within six months from the passing of this Act. The Act further provides for the acquisition of additional lands, and confirms arrangements already made with the Midland Railway Company.

The *Folkestone Gas Act* authorizes the Folkestone Gas Company to raise £60,000, the dividends being limited as usual, and to borrow £15,000 in respect thereof. By their Act of 1865, the company were empowered to raise £36,000 share capital, and to borrow £9000. They only borrowed £2000, and raised the other £7000 by shares, and have since converted the sum they did borrow into capital. Thus the company have, at present, no mortgage debt. The present Act contains the now usual clause, prohibiting the company from raising money authorized to be borrowed, by the creation of shares or stock, and further enacts that borrowed money converted into capital shall be entitled to only five per cent. The company are now required to supply fourteen-candle gas at the pressures usually prescribed. The test burner is Sugg's "London" Argand, No. 1. Power is, of course, given for the purchase of land necessary for the enlargement of the works.

The *Gaslight and Coke Company's Act* has been so fully described and commented upon in our columns, that no further reference is here required.

The *Rossendale Union Gas Act* authorizes the Rossendale Union Gas Company to raise £100,000 additional capital, and to borrow £25,000. The dividends on the new capital are limited to seven and a half or six per cent., according as it is raised by ordinary or preference shares. The absorption of the Bacup Gas Company in 1854 necessitated the creation of certain "eighth shares," of the nominal value, we presume, of £1 5s. each. The Act, we notice, empowers the directors to convert eight of these into one ten pound share of original capital. Fewer than eight of these shares will be redeemed on behalf of the company by the payment of £2 15s. for each. Authority is given for the purchase of certain lands. Gas of fourteen-candle power, tested by Sugg's "London" burner, No. 1, is to be supplied.

The *Southampton Gas Act* makes a small extension of the limits of the Southampton Gaslight and Coke Company, and enables them to raise further capital to the amount of £100,000, and to borrow to the usual extent of one-fourth of that sum. The dividend on the new capital is limited to seven or six per cent., according as the shares are issued as ordinary or preference. Gas of fourteen-candle power is now to be supplied by the Company, and the test burner is one approved by the Board of Trade, or Sugg's "London" Argand, No. 1.

The *South Metropolitan Gaslight and Coke Company's Act* has already been fully noticed and discussed.

The *Tunbridge Wells Gas Act* is simply to empower the Tunbridge Wells Gas Company to acquire a new site for works, and a better one than that they purchased under the powers of an Act they obtained last year.

PRESENTATION TO AN EX-GAS SUPERINTENDENT.—On Friday evening, the 10th inst., about 40 of the hands employed in the gas department of the Bolton Corporation assembled at the "Derby Arms," Derby Street, for the purpose of presenting to Mr. G. Crook, late foreman and superintendent of the Gas Street Works, a tribute of their respect. In February last, whilst travelling on the London and North-Western Railway between Bolton and Atherton, Mr. Crook met with an accident of a rather serious nature, which temporarily disabled him from attending to his duties; and subsequently, finding little improvement in his condition, Mr. Crook tendered to the corporation his resignation of the situation he held. The men at Gas Street Works and the outside main-layers, &c., who had been those more immediately connected with Mr. Crook, originated a subscription amongst themselves, and raised a sum of £21 18s. 6d., which was presented to him on the evening above stated. Mr. Giles Partington was voted to the chair, and introduced the business, calling upon Mr. Walch, the cashier, to make the presentation. Mr. Crook acknowledged the presentation, and alluded in feeling terms to his connexion with the gas-works, speaking in high praise of the men who served under him, and assuring them of the regret he experienced in having been compelled to part company with them, but which could not be avoided, as he was afraid the nature of his injury was such that he could not hope to devote himself to active duties again.

GAS EXPLOSION AT NUNEATON.—On Monday morning, the 20th inst., a serious gas explosion occurred at the residence of Mr. J. Allen, a publican, grocer, and baker, at Chilvers Coton, Nuneaton. On Sunday night the chandelier in the sitting-room was pulled down, and left in that position, the taps being turned off. It is believed that gas escaped from the pipe at the upper part of the chandelier. Early on the Monday morning Mr. Allen got up, and, having lighted a candle, went downstairs. On opening the door of the sitting-room an explosion occurred. The door was blown to pieces, all the front and back windows, especially in the lower part of the house, being shattered. Some of the window-frames were forced out, one at the rear of the house being carried some distance across the yard. The large frame of the shop-window was also lifted out, on to the ground below, the goods in the shop being scattered in all directions.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

CXIX.

DISTRIBUTION (*continued*).

The first street-mains laid down by Winsor, in Pall Mall, were of lead. These were not constructed like lead pipes at the present day, but simply of sheet lead of varying thickness, proportionate to the diameter of the pipe, bent round a mandril or core, and soldered at the edges. This was in 1807; but on the introduction of cast-iron pipes a few years afterwards, the leaden tubes were removed and replaced by the latter.

Murdoch's first mains were of tinned iron and copper. In the lighting of Messrs. Phillips and Lee's mill and other premises in Lancashire, between 1805 and 1808, his mains varied in diameter from 5 inches downwards; the larger sizes being of cast iron, and the smaller tubes of sheet iron.

The New River Company began to make use of cast-iron mains in the year 1810; prior to that time their pipes were chiefly the trunks of elm trees, bored by means of augers to the required size; the exteriors being left in their natural rough condition. We are not aware that these wooden tubes were ever attempted to be employed in the distribution of gas. Wood gas-pipes, however, are at the present time somewhat extensively used in the United States. They are principally made from tamarck logs, and are of great durability when laid in wet soils; the leakage from them is said to be but small. When Clegg accepted the post of engineer to the Chartered Company in 1813, the first mains he employed were of cast iron, and 2 inches in diameter.

A peculiar description of pipe was, some time ago, invented by M. Chameroy, a Frenchman, which has been extensively employed in France and the Continent. It is formed of tinned sheet iron bent into cylindrical lengths, which, on being rivetted and soldered, are coated on the exterior with a layer of asphalte intermixed with sand, of from a quarter to half an inch thick. The iron sheets range in thickness from that of ordinary tin plate, up to No. 16 gauge, according to the diameter of the pipe to be constructed.

The method of manufacture is as follows:—The sheet iron, which is leaded, is cut, according to the required dimensions, into lengths of about 2 mètres (6 feet 6 inches), and after having been rivetted with tinned rivets, 3 inches apart, the pipes are soldered throughout their entire length by plunging the joints into a lead bath. The two lengths are afterwards united together by rivets and tin solder, to obtain a total length of 4 mètres (about 13 feet). Previous to 1855 the joints were made by a metal screw run on to each extremity. The inconveniences which this system of jointing presented—notably the impossibility of making pipes of greater diameter than 12 inches, the difficulty of screwing the joints together in their places, the employment of special tools, and, above all, the effect of torsion to which the pipes had to be submitted—caused this species of joint to be abandoned, and it has been replaced by a socket joint, which may be applied to all diameters. This joint, composed of an alloy of lead and antimony, is formed of an exterior cylindrical part run upon one of the ends of the pipes, and sliding by friction into a socket of the same metal run into the other end. This joint is easy of application, and forms a compensator, which gives to all the separate pipes the faculty of expanding and contracting, according to the variations of temperature. After having run upon the pipes the rings which constitute the joint, they are tried under a hydrostatic pressure of eight or ten atmospheres. The exterior surface is tarred over, and a cord is wound round, after which it is plunged alternately in a bitumen bath, and rolled in fine gravel, till a layer of this coating is obtained five-eighths of an inch thick for pipes of 28 inches in diameter, and one-fourth to five-sixteenths of an inch thick for pipes of smaller dimensions. The pipes are then finished by being rolled upon a table in fine sand. The plumbing work of the service-pipe is easily performed, in consequence of the presence at all points of the pipe of leaded sheet iron, upon which the soldering is more readily done than upon lead itself. The Paris Gas Company, whose unaccounted-for gas is under 10 per cent., employ them extensively, and report favourably of their use. The loss per 1000 mètres of cast and sheet iron pipes is estimated by their engineer to bear the following proportions to each other:—

	Cast Iron.	Wrought Iron.
In consequence of accidental ruptures . .	1·60 . .	0·46
In consequence of use and waste in the body of the pipe	0·353 . .	0·198
In consequence of the shaking or disturbance of joint	1·77 . .	0·52

This was the result of observations made in the year 1861, and since that time the company, in replacing their canalization when the exigencies of the supply have rendered it necessary, have substituted the "Chameroy" pipes for the previous ones of cast iron. Some of these pipes laid down in 1837 are still in wear, and exhibit no signs of decay. On the other hand, engineers who have had experience in their use have condemned their employment, though principally on account of the difficulty of making the joint. No doubt their durability and efficiency altogether depend on the care bestowed on their construction, and the amount of protection afforded to the jointed parts when laid in the ground. They are known by the name of "Chameroy" pipes, after the inventor. One serious objection to the sheet-iron pipes is, their liability to puncture by the picks of workmen engaged in opening the streets.

An attempt has also been made to introduce pipes constructed of wood and asphalte, but with no great success. These were manipulated as follows:—A cylindrical mould, the same diameter and

length as the intended pipe, was formed of sheet iron. This being fixed to an axle, and made to revolve at a speed, at its circumference, of about 6 feet per minute, pieces of wood, one by one, were laid and bound on it by one or more lengths of hoop iron 1-20th of an inch thick, and half an inch wide, drawn off a reel by the revolution of the cylindrical mould, friction being applied to the reel to keep the binding iron sufficiently tight. The pieces of wood employed were about a quarter of an inch thick, 18 inches long, and 3 to 6 inches wide. These were creosoted, and the grain of the wood ran obliquely to the length of the piece. When the pipes were to be furnished with spigot and socket joints, these, being made of cast iron, were driven on the ends. A jacket of thin sheet iron was then bound closely round the outside, the whole heated to about 220° Fahr., and being set upright, asphalte, in a state of fluidity, was poured in at the top between the inner and outer cylinders of iron, and flowing down amongst the pieces of wood, filled up the interstices, making a solid concrete of the whole. When cold, the inner and outer sheets were removed. The thickness of these pipes, which was in proportion to their diameter, was increased or diminished by giving the pieces of wood greater or less lap.

Pipes of bitumenized paper have also been manufactured and tried, but though high anticipations were at first formed of their success, the result has not been such as to warrant their extensive adoption. These pipes are made by passing an endless band of paper, as wide as the length of the pipe, through melted bitumen, and rolling it round a cylinder, the circumference of which corresponds with the diameter of the pipe to be manufactured, until it obtains the required thickness. Another cylinder passes over the paper that is impregnated with bitumen, so as to spread the latter over it equally. The pipe, after being cooled and removed from the interior cylinder, is coated inside with a fine and insoluble varnish, and the exterior is covered with a mixture of bitumen and fine gravel. When pipes of this description are used for gas, it is absolutely indispensable to line them with a thin coating of lead, and even in that case the hydrocarbons may penetrate to the bitumenized paper, and rapidly decompose the pipes.

Cement, concrete, and earthenware pipes have been tried in some foreign towns, owing to the difficulty at one time experienced in obtaining cast-iron pipes, and their great cost; but these have invariably proved a failure. A tile main was laid down by the Cambridge University and Town Gaslight Company about 34 years ago, but has long been discontinued on account of the unsatisfactory results obtained from it in regard to leakage, and the objections to drilling for the insertion of services. This pipe was the leading main from the works, and was half a mile in length. The tiles were made of Newcastle fire-clay, 12 inches in diameter, and 2 or 2½ inches in thickness; they resembled the ordinary draining tiles, with the exception that they were in two halves, rebated, and overlapped, fitting one upon the other, being jointed with Roman cement.

In 1860, M. Sébille, of Angers, discovered a means of making pipes from slate refuse, formed into a paste with a melted resin solution, and moulded to the required length and shape. The pipes, which hardened on cooling, became strong enough to resist a pressure of twelve atmospheres. They were incorrodible, and unaffected by acids. The inventor claimed further advantages for these pipes on account of their cheapness, and for the facility with which they could be lengthened, jointed, and repaired. For joining one pipe to another, M. Sébille used an instrument which, on being applied red hot to the ends, softened the material, and so united them together. Cracks were repaired, and services inserted in the same way. Notwithstanding the apparent success of the invention, the pipes have not been adopted to any great extent.

It is generally admitted that cast-iron is the material best adapted for the manufacture of main-pipes. These should be of equal thickness throughout their length, with the exception of the socket, which ought to have a slightly thicker body of metal, to afford greater strength to resist fracture in the operation of jointing.

Unless pipes are cast vertically in dry sand moulds and loam cores, with their socket or faucet downwards, it is not to be expected that this condition of regularity in the thickness can be fulfilled; and yet we know that, oftener than otherwise, they are cast either horizontally or in but a slightly inclined position. We find, in consequence, that in drilling such mains for the insertion of the service-pipes, the metal is frequently not a quarter of an inch in thickness, and even this is further reduced by careless or unskilful workmanship, or by the use of improper tools in making the holes. We admit having seen pipes of various sizes that have been cast in an almost level position, as regular in the thickness of their crust as any cast vertically; but great care has been observed in their manufacture; and certainly the chances of irregularity in thickness and solidity of metal, by the former method of casting, are many.

Belts or bosses, about a yard apart, are sometimes cast on the pipes, to ensure a proper thickness of metal in drilling. (See fig. 1.)

These are, no doubt, useful, and answer the purpose intended, to some extent; but it will be apparent that in frequent instances, the service-pipes have to be diverted from the straight line to admit of the belt or boss being avilable. To obviate this objection, Mr. Cathels, of the Montreal Gas Company, some years ago patented a pipe having two continuous ribs running longitudinally, one on each side, with their faces either vertical, or slightly inclined upwards, suitable to the fall of the services, fig. 2. If preferred, the ribs may be cast higher up on the sides of the pipe, and the services attached by obtuse connecting-bends, or there may be only one rib on the top of the main.

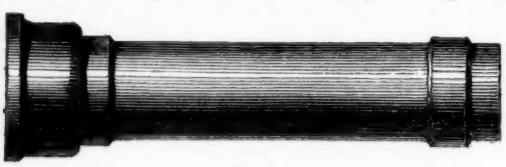

Fig. 1.

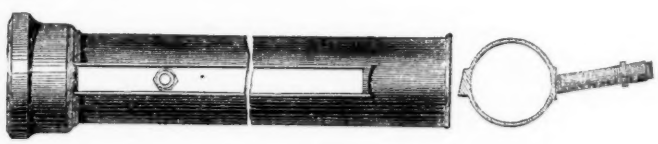

Fig. 2.

The ribs extend from the back of the socket to within about 9 inches of the spiggot end of the pipe, and are 2 or 2½ inches in width, and of such thickness in addition to the strength of the pipe as to give a total thickness of about an inch of metal. On being drilled and tapped, they afford a sufficient threaded surface for the service-pipe, and secure a perfect joint. In the casting of such pipes, extra care has to be exercised to prevent unequal contraction in cooling, and hence arises a slight increase in their cost over the ordinary description; but this is amply compensated for in the advantages their use is calculated to afford.

All cast-iron pipes intended for the conveyance of gas should be tested with a pressure of at least 150 feet head of water, being equal to about five atmospheres, or 75 lbs. on the square inch. This is requisite in order to detect flaws in the metal, such as blown places, blisters, shrinkage cracks, and sand holes; and whilst under such pressure, they should be smartly rapped from end to end with a hammer; the sound emitted—dull or bell-like, as the case may be—indicating the presence or otherwise of flaws and imperfections.

Of one thing we are assured, that there is no saving in badly constructed pipes, however low the price at which they may be obtained. We have, in the course of our experience, seen mains being laid that would have been dear as a gift.

(To be continued.)

Communicated Article.

WATER COMPANIES CHARGES.

(FROM AN OCCASIONAL CORRESPONDENT.)

It is exactly because we desire to see the relations between the Metropolitan Water Companies and their customers placed upon a more satisfactory footing, that we cannot express unqualified satisfaction with the conference which was held a few days ago. Comparatively few of the Metropolitan Vestries and District Boards were represented, and the delegates do not appear to have made any progress in the study of the question since the outlines of the special grievance were stated in the letter of Lord Camperdown, which was published in the summer or autumn of 1875. The grievance is simply this—that the companies, being entitled to make per centage charges on the annual values of houses, increase their charges when the values of houses are raised by re-assessment. None of the delegates seem to have got beyond this statement of the grievance, which was made with many varieties of illustration; nor did any of the delegates know what were the relations of the companies to the public, as fixed by Act of Parliament. After the publication of Lord Camperdown's letter, the subject was talked about at some of the vestries, and was taken up at the Metropolitan Board of Works. That Board determined to introduce a bill into Parliament last session, for the purpose of settling the disputed question whether the companies were entitled to charge on gross values or on rateable values, and to give the consumer the option of being supplied by meter. But the intention was afterwards abandoned, and nothing whatever was done. In the meantime what had happened? One vestry, at least, had gone into the question thoroughly, and had pronounced against the supply of water by meter for domestic purposes, as unjust in itself and contrary to public policy. This was the Lambeth Vestry, which had referred the accounts of the local water companies, and Lord Camperdown's letter, to one of its then members, with a request that he would analyze the accounts and report whether they contained any information which would indicate a remedy for the complaints made. The member in question, Mr. William Storr, not only analyzed the accounts, old and new, of the Lambeth Company and the Southwark and Vauxhall Company; but he made a report (a considerable portion of which we republished), embodying the information of which the vestry really stood in need. All the metropolitan companies are bound to publish their accounts in a form prescribed by a recent Act of Parliament, but the two great southern companies, and probably all the metropolitan companies, are otherwise governed by separate private Acts. From the accounts, and from these Acts, Mr. Storr extracted not only the scales of charges which the companies are empowered to make, but also the amounts of capital they have been authorized to raise, and the rates of interest that may be paid thereon. There is an intimate connexion between the capital accounts and the charges for water. In the case of both companies a maximum dividend of 10 per cent. may be paid upon the bulk of the capital, but the maximum is restricted to 7½ per cent. in respect of certain portions of the capital. There is a great difference between the two companies scales of charges, one being very much higher than the other; but the important point is, that, just as the dividends named are maximum dividends, so the charges named

are maximum charges. The obvious intention of the duplicate arrangement is, that a company may charge up to their full scale, if they think proper, in order to realize their maximum dividend, but, however low the dividend may be, they may not exceed the full scale of price, and if their income provides it with a greater balance than is necessary for dividend and an authorized reserved fund, they must diminish their receipts by lowering their charges. Under these circumstances, the first question which suggests itself is—What dividend is a company paying? It appears that the two southern companies are not paying the maximum authorized dividend of 10 per cent. per annum on their ordinary capital; but the accounts represent one as paying between 5 and 5⅛ per cent., and the other as paying 6¼. The accounts laid before Parliament will show what all the other companies are paying. Then, as regards the charges for water, it is admitted that in many cases, even in some in which advance with assessment is complained of, the companies are not exacting the maximum sums authorized by their scales. Were they imposing the full per centage charges, and also all the charges for extras, on all householders, and yet not paying the maximum dividend authorized by Parliament, there would be no legal grievance calling for a remedy; and there is no injustice in any single case in which the charges made do not exceed the limits of the scale in force. In accepting the statements made as to the limitation of the actual dividends, we are dealing with the accounts as they stand, without expressing any opinion as to the sufficiency of the audit. If a company are not paying their maximum dividend, nor enforcing their maximum charges, it is difficult to see what ground of complaint there can be in the fact that charges rise with the increased value of property, which is practically the only basis on which the existence of a water supply can be paid for. We say the existence of a supply (assuming, of course, purity and sufficiency) as distinct from the quantity consumed; for it is the existence of the supply which gives value to property, and it is difficult to distribute the cost otherwise than rateably over the property that is benefited. It is not only that water is wanted for domestic consumption, which may, sometimes, vary inversely with the rent of houses, but public health calls for its unrestricted use, and the protection of life and property calls for an unlimited supply. The argument that a man is to pay only for what he uses is reduced to an absurdity when it is applied to a man who has had his house on fire; but even he is less a gainer than his neighbour, to whose house the flames might have extended, if there had not been a supply of water to put out the fire. We are, of course, assuming, for the sake of argument, that the obligation of a company to provide such a supply is enforced just as much as that obligation would be recognized by a local authority entrusted with the water supply. No one at the conference was prepared with information as to the authorized dividends and the authorized charges of any of the companies. Perhaps the committee who are appointed will follow the example of Mr. Storr, and collect these particulars. His report furnishes them for the two great southern companies, and the other companies would probably facilitate a reference to their Acts, if appealed to. If it should be found that any company are paying a higher dividend on any of their capital than is authorized, or are exceeding their legal scale of charges, it can be hardly necessary to appeal to the Home Secretary for redress. If it be found that the companies are paying only maximum dividends, or lesser dividends, and are not exceeding their fixed scales, the committee will have to consider whether the increased assessment has so far altered the positions of the companies as to justify a revision of their scales. It was no doubt intended that the companies should impose their maximum charges without reaching their maximum dividends, and that there should be a considerable margin to be struggled for by economy and improved management. The question is whether the increase of the assessment has unduly diminished that margin. It would also be interesting to ascertain to what extent the companies are charging on their full scales, and to what extent below them. It is clearly the interest of the companies not to drive their consumers to use only well water and rain water, and policy would therefore dictate the keeping down of the charges in cases in which they would be oppressive. If it should be found that, from motives of self-interest or prudence, the companies are undercharging many of their customers, it may be a question whether the rigid enforcement of a reduced scale would not inflict a heavier burden on the community than the discriminating application of a higher scale. Several suggestions made in Mr. Storr's report were unanimously adopted by the Lambeth Vestry, and it would be useful to consider this application to the Metropolis. If practicable, it would be desirable to have but one scale, which should be readily accessible to all consumers. The Lambeth Company have a printed slip for distribution. It would be well to determine whether gross or rateable value is intended, and, as certain charges for extras are restrictive in their operation, and, therefore, contrary to public policy, it would be well to include them in the per centage charge on the total value, of which the extras form part. We purposely abstain from speaking of the quality of the water supplied, or the expediency of transferring the undertakings of the companies to a local authority, because those questions are not raised; but that which is now complained of as a grievance, might have arisen under the management of a public body authorized to levy rates on the basis of undefined annual values. The additional sums collected would have gone into public funds, but the individual hardship would have been the same.

WARRINGTON WATER-WORKS.—At a meeting of the directors of the Warrington Water-Works, on the 17th inst., Mr. Ross, borough surveyor of St. Helen's, was appointed engineer and secretary to the company in the room of the late Mr. James Riley.

Correspondence.

TESTING-STATIONS FOR THE COMMERCIAL GAS COMPANY.

SIR,—In your "Circular to Gas Companies" of Nov. 14 you remark on the expense caused to the Commercial Gas Company by the Referees prescribing two testing-stations for their small district.

Allow me to explain that section 32 of the company's Act of 1875 expressly provides that one testing-place shall be prescribed "for every station from which gas is supplied."

Hence, as the company supply gas from two stations, the Referees had no option in the matter.

The Metropolitan Gas Referees, WM. POLE.
17, *Buckingham Street, Adelphi, W.C., Nov.* 17, 1876.

[The terms of the 32rd section, perhaps, justify the decision of the Referees, but in the absence of the word "separate" we are still inclined to believe that an arrangement might have been come to between the Company, the Metropolitan Board, and the Referees, in virtue of which the gas from both stations could be tested under the same roof.—ED. J. G. L.]

BACK DIVIDENDS *VERSUS* RESERVE-FUND.

SIR,—It will, I fear, be very unsatisfactory to your readers to find that after wading through all this correspondence they have only been brought back to the point whence they started. Your correspondent has changed his position, and now says, "Can the companies pay back dividends after the formation of a reserve-fund?" And I contend that companies under this Act (unless otherwise empowered by special Act), after having formed a reserve-fund are precluded by *laches* from paying back dividends. In my first letter on this subject (17th ult.) I said, "The utmost that could be alleged against a company for making a reserve-fund before paying off the back dividends would be that in so doing they had waived their right to pay back dividends from that time." Your correspondent says that clause 31 provides that the reserve-fund is to be applied to making up any deficiency in the current dividend. In this I heartily agree with him, as, if there is any doubt as to the meaning of clause 31, there can be none as to the meaning of clause 34, which is to the following effect:—"If in any year the profits of the undertaking divisible amongst the undertakers shall not amount to the prescribed rate, such a sum may be taken from the reserved fund as, with the actual divisible profits of such year, will enable the undertakers to make a dividend of the amount aforesaid, and so from time to time as often as the occasion may require." But what has this to do with back dividends? Suppose the reserve-fund to be full, and the profit to be more than sufficient to pay 10 per cent., what then? May the excess be applied to the payment of back dividends, or must it be applied to a reduction of the price as provided by clause 35? That is the point we started from.

Clause 35 says, "If the profits of the undertakers for the preceding year have exceeded the prescribed rate, the undertakers shall, in case the whole of the said reserved fund has been and then remains invested as aforesaid, and in case *dividends to the amount hereinbefore limited have been paid,* make such a rateable reduction in the rate for gas to be furnished by them, as in the judgment of the court shall be proper," &c. These words might be held to mean either 10 per cent. for the current dividend, or 10 per cent. for the whole period the company had been in existence. If the former meaning is the correct one, the company are precluded from paying any back dividend from that time; but if the latter, they are not so, and this is the only way in which the making of a reserve-fund affects the payment of back dividend; but this is a point upon which there might well be a difference of opinion, and I do not presume to express one either one way or the other.

It is impossible to decide what is intended by an Act of Parliament by reference to one clause alone; you must study the Act in its entirety before you can do so, and it is not possible to succeed at all times even then. Clause 31, which is the only clause that authorizes the formation of a reserve-fund, says, "If after paying the back dividends and making a dividend of 10 per cent. there is any surplus, it may be appropriated to a reserve-fund." If, therefore, the clause is to be acted upon in the order of sequence, as your correspondent argues, the back dividends must be made up before the current dividend can be paid, which it is impossible to suppose was ever intended. The order of sequence, therefore, will not assist us. Your correspondent, if I understand him rightly, seems desirous of making your readers believe that the words "legality" and "imperative" have, in a parliamentary sense, the same meaning; but against this I must strongly protest.

It is legal to pay current dividends at the rate of 10 per cent., and to make up all back dividends to that rate; but it is not imperative to do either. Many of your readers would, no doubt, be highly delighted if it were so.

The power to pay 10 per cent. and back dividends is of no value, if a company, from any cause whatever, have not the means of exercising the power. In such a case both would be "myths," and the mention of them in connexion with coupons only serves to create a very wrong impression as to what they really are.

Another correspondent says. "Considering the very loose construction of the Act itself, together with the decision of the Master of the Rolls, in the Worcester New Gaslight Company's case, that even when viewed in the 'abstract,' the ground is *not* so 'clear and open' as Mr. Livesey expresses it *is,* in his opinion."

Your readers, aware that we have been discussing exclusively the provisions of the Gas-Works Clauses Act, would infer from this that the Worcester New Gaslight Company were under the Gas-Works Clauses Act, *but it is not so. Let it be clearly understood.*

The Gas-Works Clauses Act was passed in 1847, but for several years previously most of the principal clauses of that Act (but not all) were incorporated in detail in every special Act relating to gas.

The Worcester New Gaslight Company were incorporated in 1846, and the clause in their Act upon which this question arose is as follows:—

"Clause 28. And be it enacted that if in any year *after the passing of this Act* the profits of the undertaking, divisible amongst the proprietors thereof, shall not amount to the sum of ten pounds per centum per annum, on the amount paid in respect of every share, then (*whether such deficiency shall have occurred before or subsequently to the formation of such contingent-*

fund) such a sum may be taken from the contingent-fund as, with the actual divisible profits of such year, will enable the company to make a dividend of ten pounds per centum per annum on the amount paid in respect of every such share, and so from time to time, as often as the divisible profits of the company shall fall short of ten pounds per centum per annum, on the amount paid in respect of every share."

Let your readers peruse the clause first, leaving out the words *italicized*, then read it again, taking them in, and ask what is the meaning of them.

The Gas-Works Clauses Act expressly authorizes the payment of back dividends, and refers to such payments in a variety of ways; but the Worcester Gas Act does not say a word about back dividends. If there had been such a provision in that Act, these words would have been very significant; but in the absence of such a provision they are meaningless. The decision in that case, be it right or wrong, does not decide or affect the provisions of the Gas-Works Clauses Act.

In 1860, when the first great fight between the local authorities of the Metropolis and the Metropolitan Gas Companies took place, it was proposed by the authorities to place all the companies under the Gas-Works Clauses Act, and this the companies consented to; but the local authorities then said: We must have the Act altered to some extent, as the companies, if placed under the Act as it stands, would be authorized to make up all their dividends from the commencement of their operations to 10 per cent., and we should never get any reduction in the price of gas at all.

This proposal the companies strongly objected to; but in the end the power of paying back dividends was limited to six years; but although all the leading parliamentary counsel were engaged in the case on one side or the other, the right of a company to make up all previous dividends to 10 per cent. under that Act was never once questioned by either side. I repeat, therefore, my assertion, that the right of the companies, *under the Gas-Works Clauses Act*, to pay back dividends is beyond all doubt.

Your second correspondent, like the first, quotes part of my argument (leaving out the most important part), and then proceeds to comment on it. He says, "It is also impossible to agree with Mr. Livesey in advising the making of a reserve-fund, so that all should be 'benefited alike,' as preferable to paying back dividends, for this contingent-fund could never benefit anybody, except in the event of a deficiency which might never happen."

What I said was this, "Paying back dividends merely confers some temporary and inappreciable benefit on the shareholders of the time, while the *formation of a reserve-fund gives a substantial and permanent improvement to his property*, and, perhaps, increases the value of it more than the amount of the dividends; and who, in the face of the large experience we have had in the matter, can question this?

W. Livesey.

Gas and Water Companies Association, 6, Victoria Street, Westminster, S.W., Nov. 25, 1876.

TEN AND SEVEN PER CENT. DIVIDENDS.

Sir,—From the letter of "An ex-Secretary," which appeared in the Journal of the 21st, it would seem that there is, indeed, some very great confusion, at least in some quarters, as to the rights of the different classes of shares to rank upon profit for dividend.

I think your readers may take it for granted that the natural, and I believe legal, operation would be to pay the maximum dividends upon such class of shares or stock when the profit admits of that being done. When the profit is *not* sufficient to pay the maximum dividends, much would depend upon circumstances as to the appropriation. Thus, suppose a company with three different stocks—say a 10 per cent., 7 per cent., and 6 per cent.—if the deficiency amounted to a sum equal to one-half per cent. only upon the 10 per cent. stock, the general meeting would probably declare dividends of 9½, 7, and 6 respectively; but supposing the deficiency amounted to a sum equal to 2 per cent. upon the 10 per cent. stock, then it would be manifestly unjust to take *the whole* of the deficiency out of that stock. The loss of dividend should be suffered by each class *pro ratâ*, and dividends declared, say of 9, 6½, and 5¾, or some other workable figures. It is quite a mistake to suppose that any stocks have *quasi* preference—are to be paid in full—till all above them are brought down to their (or its) level—the appropriation of profit is entirely in the hands of proprietors in general meeting assembled, subject only to statutory preference dividends; or, as in the Imperial 7 per cent. stock, to which your correspondent refers, where it is provided that its dividend shall not fall till higher dividends are brought below it. This stock was issued under this condition; but to set up a theory that such a partial preference is the "law" of the case, is, I think, unjustifiable; indeed, were it so, what need had the "Imperial" so to *specifically provide?*

I do not apprehend any such injustice as your correspondent forecasts at the hands of a general meeting. One usually finds fair dealing "all round" at such assemblies; and, again, shareholders mostly hold some of *each kind* of stock, and so long as they get all the profit *somehow*, are moderately content. At any rate, the stocks are out, and therefore no such distinct classification can now be set up. We must depend upon common sense and common honour.

A Proprietor.

London, Nov. 23, 1876.

ESTIMATING THE ILLUMINATING POWER OF COAL GAS.

Sir,—In the issue of the Journal for Nov. 14, p. 707, "On Estimating the Illuminating Power of Coal Gas," there are the following remarks by the late Dr. Letheby: "Or it" (the intensity of the flame) "might be measured, as he had proposed, by ascertaining its penetrating power in passing through a medium of given opacity—say a piece of dark bottle-glass, cut in a wedge shape."

It may interest your readers to know that the indications given by a photometer constructed on this principle bear no relation whatever to the indications of the ordinary Bunsen photometer.

The instrument experimented on was formed of two brass tubes sliding into each other like the tubes of a telescope, with a water-tight joint between them, and glass ends to each tube. The space between the tubes was filled with a dark-coloured liquid, which, as the inner tube was drawn out, flowed into the space between the two tubes from a small reservoir attached above the outer tube. The distance the inner tube was drawn out, which was the thickness, of course, of the liquid, was shown on a scale. Four bat's-wing burners were placed side by side, nearly, but not quite, touching each other at one end of the scale of a Bunsen photometer, with a standard candle at the other end. The instrument was fixed at a distance, with all four jets in the field of view. One of the burners was then lighted, showing on the photometer-scale an illuminating power of about 10 candles, and the thickness of liquid necessary just to obscure the light was carefully noted. A second burner was then lighted, and the illuminating power showed about 20 candles; but the thickness of liquid necessary for complete obscuration was the same as before. Similar results followed on lighting the third and fourth burners—the four burning together, and indicating an illuminating power on the photometer-scale of about 40 candles, required exactly the same depth of liquid to obscure them as one flame only, indicating 10 candles illuminating power. In the above experiment the flames were side by side; when placed in a line, one behind the other, the results were substantially the same.

My impression, after many experiments, was, that an instrument constructed on this principle indicated *intensity* of light only, as opposed to *quantity;* but as *quantity*, and not *intensity*, is what is useful to consumers of coal gas, an instrument of this kind would be of no use in gas-testing, though for some purposes it may have its value.

The experiments were not on a sufficiently extended scale to show the ratio between the depth of liquid required for complete obscuration and the intensity of the light. It certainly could not be a direct ratio; but the experiments described, and many others, proved beyond question that it had no relation whatever to the indications on the Bunsen photometer.

Alex. Milne.

Silverdale, Carnforth, Nov. 17, 1876.

LIMERICK GAS UNDERTAKINGS.

Sir,—I was rather surprised to find, in your issue of the 21st inst., a statement of the Limerick gas undertakings; and as you have inserted one version of the rival concerns accounts, drawn up peculiarly, inasmuch as comparative statements to Dec. 31, 1875, and to June 30, 1876, are scarcely fair, perhaps you will do me the favour to insert a half year's accounts, both to the 30th of June last, when the comparison will stand thus:—

United General—		
Capital subscribed	£36,000	0 0
Receipts	4,346	18 3
Net profit	493	2 1
Corporation Company—		
Capital	31,331	5 8
Receipts	4,660	8 11
Net profit	167	18 4

D. W. Ogg, Secretary.

United General Gaslight Company, 3, Jeffrey's Square, St. Mary Axe, E.C., Nov. 23, 1876.

UNITED GENERAL GASLIGHT COMPANY.

Dr. *Profit and Loss Account, for the Half Year ending June 30, 1876.* *Cr.*

Coals, 1686 tons 10 cwt., at £1 2s. 6½d.		£1398	9 8	Gas-rental—	
Wages		364	4 7	For quarter ending March 31. £2097 4 6	
Salaries		189	19 0	For quarter ending June 30 884 16 0	
Rent and taxes		209	1 7		£2982 0 6
Charges—Limerick £212 14 7				Coke and breeze	1123 13 3
Do. London 75 0 0				Tar	134 4 6
	287 14 7			Sulphate of ammonia	107 0 0
Allowances, &c., £198 8s. 6d.					£4346 18 3
—B. D., £28 2s. 9d.	226 11 3			Balance brought down	£601 10 7
Wear and tear	363 13 2			Do. of old profit. £165 6 2	
Gas-meters	93 13 8			Dividend on Consols 69 4 7	
Depreciation of plant	112 0 2				234 10 9
	£3745 7 8				
Balance	601 10 7				
	£4346 18 3				£836 1 4
General expenses £28 18 2				Balance brought down	£727 12 10
Pensions of the Co. 79 10 4					
	£108 8 6				
Balance, net profit	727 12 10				
	£836 1 4				

Examined and found correct. (Signed) W. G. Head, R. H. Jones, } Auditors.

Aug. 30, 1876.

LIMERICK CORPORATION GAS-WORKS.

Dr. *Profit and Loss Account, for the Half Year ending June 30, 1876.* *Cr.*

Coals		£2241	11 9	Private lighting this half year	£2564 9 2
Wages		613	7 2	Public lighting for corporation, £5 per lamp per annum	986 7 6
Lime		14	5 3	Harbour Board	58 11 6
Salaries		295	3 9	Coke, tar, and residuals	1051 0 9
Renewals and repairs		149	12 1		£4660 8 11
Charges account		168	7 4½		
Public lamps, lighting and repairs		158	13 9		
Rent and taxes		47	19 5		
Discounts and allowances		88	0 6		
Bad debts		25	0 0		
Plant depreciation		194	2 2		
Meter do.		156	13 10		
Profit and loss		507	11 10½		
		£4660	8 11		
National Bank for Interest		£339	13 6		
Balance		167	18 4½		
		£507	11 10½	By revenue account, half year's profit	£507 11 10½

Sept. 14, 1876. (Signed) W. Spillane.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS—THE PRESIDENT ON DRY METERS.

Sir,—Referring to the President's remarks on the tying of dry meter diaphragms with cord, and the preference he expressed for wire, allow us to state that, to the best of our knowlege, all Scotch makers use wire for this purpose, as we ourselves do, both in our London and Edinburgh factories. Why some London firms still continue the use of cord, so long after its disadvantages have become known, is one of the mysteries of this conservative period. We have, ourselves, repaired about 1600 dry meters for one gas company lately, and found at least a dozen of them with the cord in the state referred to by the President.

But, however important this matter may be, it would be unfortunate for gas companies if attention were thereby diverted from the inherent defects of *dry meters, as such*. Whatever may be the uncertainty as to the uniform capacity of a measure on the bellows principle, there can be none as to the great element of error existing in the valves of dry meters.

Wet-meter valves may leak, but, in doing so, do not affect the measurement. The wet-meter valve is merely a doorkeeper, admitting the gas when the measuring part of the meter is in proper working condition, but refusing admission when it is not so.

The dry-meter valves are the seals of the measuring chambers; any leakage, therefore, in them, at once and continuously affects the registration. Hence dry meters simply, as such, have in their valves a source of error, to which there is no analogy in the wet meter.

The President, referring to dry meters, observed that "in large towns, where there is a sufficient staff of workmen to look after meters, they may, with the exception of small ones referred to by Mr. Robb, work well enough; but in small towns the case is different. In my case, where, having over 900 meters to survey, and two-thirds to water, and money to collect four times a year, there is not that time at my disposal dry meters require. If a man in my position has 200 or 300 small dry meters under his charge, they keep him constantly running looking after and changing them, for many reasons." If dry meters cannot be trusted to measure correctly, without being taken down and cross-examined, say, every three years, as has been found necessary, the sooner they are discontinued, in favour of wet meters, the better both for gas companies and consumers.

The supposed convenience of dry meters is often referred to, as if the "constant running, looking after, and changing them, for many reasons," referred to by the President, was of no account.

The fact is, a well-made wet meter may with confidence be left to perform its office, with no misgiving either to the seller or buyer of gas; but it is far different with a dry meter, however well made. The worst that even a common wet meter can do is known and discounted; but who can foretell the doings of a dry?

Our firm, being one of the largest manufacturers of dry meters, may be held free from any prejudice against them, in what we state as the result of our consideration and experience.

W. AND B. COWAN.

Edinburgh, Nov. 23, 1876.

REMOVABLE DIP-PIPES.

SIR,—In the JOURNAL of yesterday's date there appear numerous letters bearing upon this subject, and as each, more or less, has reference to the dip-pipe we mentioned in our letter, which was published in the JOURNAL of the 7th inst., we trust you will find space for a few remarks, in reply to some queries which are suggested by the writers here referred to.

Mr. Hayes, who appears to speak very fairly, says, "that by the Messrs. Chandler and Stevenson's self-acting dip they (that is, various evil results) are in a great measure avoided; but it appears to me that no provision is made to prevent the back flow of gas to the retorts. Should the exhausting apparatus become suddenly deranged, the pressure of gas in the ascension-pipe raises the holder, lifting the dip-pipe out of the liquid in the hydraulic main, and a sudden back flow of gas would as readily return through the dip-pipe, and so keep the holder before mentioned in its elevated position."

We must, however, remind Mr. Hayes that the dip-pipe referred to in the foregoing, is out of the fluid *only* when the retort, through which it is governed, is *in* action; or, in other words, during the process of carbonization. The back pressure, therefore, can do no harm, as the same pressure *only* would be upon the retort as would otherwise be if the dip-pipe were stationary; in fact, with the stationary dip, the pressure would be *increased* in proportion to the depth of dip.

Then, again, the dips in connexion with the retorts which may be out of action would, of course, be perfectly sealed; consequently the *means* of communication between the hydraulic and the holder referred to would be *cut off*.

Mr. Good, evidently referring to the self-acting dip, confesses frankly that he has never tried to work a half-inch seal; but he certainly has approached very nearly thereto—viz., three-quarters; and, although we should not feel disposed to question that statement, we think he was wise in providing means by which he could readily increase the depth of seal, although we, at the same time, submit that even with this *good* arrangement it fails to control the liquid in the hydraulic main so as to maintain an equal three-quarter inch seal on *each* of the 14 dips.

One would imagine that gentleman had forgotten or overlooked the fact that at larger works than Carshalton there is not only an increase in the size of the dip-pipe, but also (in the event of an accident with the exhausting apparatus) a very great increase of back pressure; and, therefore, the area of a hydraulic main to supply a standing column of liquid, say 30 inches high for a 6-inch diameter dip, sealed *only half an inch*, would have to be approximately 8 feet in width, taking the distance between the dips as usual. Such obvious facts as these must carry conviction; therefore we do not hesitate to denounce the stationary dip of half an inch as in some cases impracticable, and in every case unsafe; but here, like Mr. Good, we must leave engineers and managers to form their own opinion.

Mr. Grenfel, in his letter, makes certain observations with regard to non-self-acting dips, which are perfectly correct. For instance, he says: "In practice, it is frequently found that a retort, when charged, is apparently sound, but upon discharging it a hole or gap is discovered; and it appears to me that Mr. Copp's anti-dip, in such a case, would prove a serious evil, and not a blessing. The reason is clear—not only would the gas be lost, which that particular retort had made, but the gas from the other retorts, or even from the holder itself, might as easily find its way through the said holes into the flues, and be lost." Mr. Grenfel further, and very properly, states, that the exhauster, creating a vacuum, would draw extraneous matters through the same thoroughfares.

The whole of the foregoing proves the undeniable necessity of having a self-acting appliance, and that we should not be misunderstood, it would, perhaps, be well if we were to describe the action of the Chandler and Stevenson's dip. Under these varying circumstances, in the first place, should a retort become suddenly leaky by a piece dropping out, or otherwise, the pressure actuating the holder immediately diminishes, and simultaneously the dip-pipe descends into the liquid. This we have proved to a demonstration in the presence of others, by simply slacking the mouthpiece lid, and allowing the least escape of gas.

With regard to the probability of the exhauster running at such a speed, so as to cause a vacuum, whether slight or heavy, the action on the dip would be precisely the same; that is to say, it would be drawn into the liquid, and thus the ingress of extraneous matter would be prevented. Although the complaints which are here justly made are not directed against the self-acting dip, we deemed it desirable to advance what we have written.

S. CHANDLER AND SONS.

104, *Newington Causeway, Nov.* 22, 1876.

SIR,—After perusing the several letters appearing in your last issue under the above heading, I feel called upon to offer a few brief remarks.

Much stress is laid upon the unsafety of my apparatus, an assumption in theory which is contradicted in practice, as so many hundreds are in use, working well, and giving no anxiety as to their safety. I freely admit that if an exhauster is employed without a regulator there would be the liability to deteriorate the gas by working at a vacuum.

I hardly think it will be maintained that a pressure of 15 inches is the ordinary working condition of the majority of works, but that by far the larger proportion of works without exhausters will have from 6 inches to 8 inches of pressure on the retorts, and nearly one half of that amount caused by the dip.

It appears to me that by being recommended to adopt a three-quarter, or even a half-inch seal, we are advised to see how near we can drive to the edge of the precipice without driving over. I am aware that by having a wider hydraulic main, and so increasing the surface of the liquor, the dip might be reduced in proportion, but in dealing with works as they at present exist, I think, with a 2-inch or a 2½-inch seal, a manager might feel tolerably safe in the case of a chokeage, also from the effects of expansion and contraction.

It is frequently found that a retort which is so badly fractured as to make but very little gas when worked through the dip, will make a fair quantity when the valve is opened, and the escape through the retort will at once be seen to diminish as soon as the charge is worked off, which can be readily ascertained by liberating the chain; the valve may remain closed to prevent any back flow, but this is only necessary when a retort is in very bad condition.

There may be stokers who cannot be depended upon, but I venture to doubt if there are many who would designedly use the apparatus to work mischief, even if it placed in their hands such a power, which I do not at all admit.

W. L. COPP.

Watchet, Nov. 24, 1876.

SIMULTANEOUS PHOTOMETER CLOCK AND METER ACTION.

SIR,—On your publication of this invention of mine, I did not think that I should feel morally bound to champion your position against all comers; however, such is the case, and, therefore, I cannot at once be "extinguished" by the extinguisher of "N. S." The bye-pass and clock are already disposed of; the extinguisher *is new;* therefore it will, I have no doubt, interest your readers as well as myself to know how this is done. Several ways of doing it suggest themselves; doubtless Mr. Wilkinson has chosen an objectionable one. So far, however, Mr. Editor, we have carried off the honours as nomenclators; this is encouraging. It is Oliver Goldsmith, I think, who says, "These little things are great to little men."

W. J. WARNER.

South Shields, Nov. 24, 1876.

Legal Intelligence.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

FRIDAY, NOV. 10.

(*Before Lord* COLERIDGE, *Lord Justice* MELLISH, *and Sir* R. AMPHLETT.)

THE MAYOR AND CORPORATION OF WORCESTER, *Appellants, v.* THE ASSESSMENT COMMITTEE OF THE DROITWICH UNION, *Respondents.*

ASSESSMENT OF CORPORATION WATER-WORKS.

It was briefly stated in the JOURNAL of the 14th inst. (*p.* 697) that this court had affirmed the decision of the court below in favour of the original appellants. We are now enabled to furnish a report of their lordships judgment.

Lord Justice MELLISH: In this case I have to deliver the judgment of Lord Justice James, Sir Richard Baggallay, and my own. The question to be determined in this case is, on what principle the Corporation of Worcester are to be assessed to the poor-rate in respect of a certain reservoir and water-works situated within the Droitwich Union, which were erected and are maintained by the corporation under the provisions of the Public Health Act, for the purpose of supplying the city of Worcester with water. The corporation contend—"That the provisions of the Public Health Act contain the only authority for the appellants to charge a water-rate on consumers of water, and that such a rate only is authorized by the statute as might be reasonably expected to be necessary to defray the expenses incident to the water supply, and that they have no authority, by the said Act or otherwise, to receive any more money from the consumers than is required to pay the above-mentioned expenses. And, further, that as the inhabitants have, on the faith of the existing rates, adopted the water supply of the appellants, and suffered their private resources to fall into disuse, without special causes it would be a breach of good faith to alter such rates, and that, therefore, the appellants are only rateable for the rent which a tenant from year to year would give for the land, subject to the existing rates and the same restrictions (if any) as those under which the appellants hold it, and not that which a tenant entirely unfettered might give." On the other hand, the Assessment Committee of the Droitwich Union contend—"That it is right to rate the appellants in respect of the water-works in Claines (as directed by section 1 of the 6th and 7th William IV., chapter 96) at what a tenant would give, with liberty to raise the price of water as he might think proper, so far as not restricted by law; that there were no restrictions by law in the present case; and that the fact that the appellants, in fixing their rates, looked only to the benefit of the inhabitants and ratepayers of the city of Worcester only transfers the advantage and benefit of the property from themselves to those inhabitants and ratepayers for whom they are trustees, and that it would be unfair that the inhabitants and ratepayers of the city of Worcester should enjoy this advantage and benefit at the expense of the parish of Claines and the rest of the Droitwich Union." It has been held by the Divisional Court of Appeal that the contention of the corporation is right, and we are of opinion that their decision ought to be affirmed. There are two questions to be considered—first, are the corporation, according to the true construction of the Public Health Act, prevented from charging for the use of the water a larger sum

than the sum they actually require for the maintenance and repair of the water-works? and, secondly, if they are, can they be rated as occupiers in respect of property which the law does not allow them to earn? Now, with respect to the first question, we think that the corporation, in making a water-rate under section 93 of the Public Health Act, are bound to make an estimate of the sum they actually require for the maintenance of these water-works, and cannot legally levy a larger sum by a water-rate than the sum they so require. The 94th section makes the water-rate payable in advance, and enables the supply of any person who neglects to pay it to be cut off, and we think it cannot have been intended that the corporation should charge any person more than his fair share of the sum which is required to maintain the water-works. There is nothing in the case to prove that the £651, which is stated to be, on the average of eight years, the whole net income the corporation have derived from the water-works, was not the whole sum they required for the maintenance of the water-works. The question then is, whether, in applying the rule given by the Parochial Assessment Act, the court is to consider what rent a tenant from year to year would give for the reservoir and the water-works, who was subject to the same restrictions the corporation are subject to, or what rent a tenant from year to year would give who was subject to no such restrictions, and we are of opinion that the hypothetical tenant is to be a tenant subject to the restrictions. The case of the Corporation of Liverpool and the Overseers of Wavertree, as reported in the *Justice of Peace*, is directly in point, and we are of opinion that case was correctly decided. Mr. Justice Blackburn there says: "The whole question turns on the rule given by the Parochial Assessment Act, which says the occupier is rateable at what a tenant from year to year will give, subject to the same restrictions as those under which the tenant holds it." This decision seems to us to be right in principle. An occupier of land is not rateable in respect of the whole profit derived from the land, but only in respect of the profit which he himself derives from the land. If there be a common in possession of the lord of the manor, he is not rateable in respect of the profits derived by the commoners from the common, although in rating the lands of the commoners, the fact of their lands being rendered more valuable by reason of the occupier being entitled to a right of common is taken into account. So in the present case the rent, and therefore the rateable value, of every house in Worcester is increased by reason of the occupier being entitled to cheap water from the water-works of the corporation; and if the corporation, in respect of the reservoir and water-works, were rated at the profit which a tenant under no restriction could get from the water-works, the same profit would be rated twice over. If the water-works were transferred to a tenant who was under no restriction as to the price he charged for water, the rateable value of the water-works would be increased, but there would be a corresponding diminution of the rateable value of the premises supplied with the water. We may also observe that the reservoir by itself, without the power of connecting the reservoir with the houses by pipes running through the streets, is probably worth nothing, and certainly not worth £610 a year, and it is the same Act of Parliament which gives the power to lay the pipes, and, therefore, creates the value of the reservoir which contains the restrictions on the amount of profit which the occupier of the reservoir can earn. Even in the case of the reservoirs of public companies established by Act of Parliament to supply towns with water, in estimating the rateable value of the reservoirs the court only considers the amount of profit which the terms of their Act enable the company to earn, not the profits which the company might earn if Parliament had enabled the company to establish water-works without restriction as to the price to be charged to consumers. So, also, in rating a railway, or any other work made under an Act of Parliament, the calculation must always commence with the profits which are actually earned according to the terms of the Act of Parliament, not with the profits which might be earned if the company were unlimited in their charges. It follows, therefore, that according to the contention of the appellants, the corporation are rateable in respect of their reservoir in a higher sum than a water-works company established by Act of Parliament would be rateable, and are rateable on an assumption which not only is not true, but which cannot be true—namely, that a tenant is in possession of a reservoir with the monopoly of the supply of a particular town with water, and is unlimited in respect of his charges.

Mr. CASTLE (for the corporation): I do not know whether it is necessary in this case to apply for costs. I suppose they follow as a matter of course.

Lord Justice MELLISH: Yes, the judgment is affirmed, and the costs follow.

EDMONTON PETTY SESSIONS.—MONDAY, NOV. 13.

(*Before Messrs.* ABBISS *and* NASH.)

Samuel M'Culloch, 5, Waggon Lane, Tottenham, gas stoker, was summoned by Mr. Broadberry, engineer and manager of the Tottenham and Edmonton Gas Company, for neglecting his work on the night of Friday, Nov. 3, and £2 was claimed as damages. Defendant did not appear, although it was stated he had been in court during the morning, and the service of the summons having been proved, the case went on in his absence.

Mr. *Broadberry* deposed that the defendant requested him to put him into the retort-house, and witness promised to do so on the first opportunity, which he did. It was the practice of the company to pay the men on Friday nights, the wages including the whole of Friday night's work. Defendant went on during the night of the 3rd of November, when he left without notice. Witness saw him outside the court that morning, and, in reply to his request to withdraw the charge, said he would lay all the facts before the justices. By his going away defendant delayed 11 other men, and the foreman had to go out and get another man to fill defendant's place. He was not missed until he was wanted at his post.

In reply to the BENCH, witness said there were 27 stokers in the service of the company; that all of them had to give a week's notice; that defendant was aware of the regulation, because he was employed last winter upon the same terms; that if the company had wished to discharge him he would have been entitled to a week's notice; that his pay was 4s. 4d. per day, but that he was liable to have his wages reduced by his being put in the yard without notice, that regulation being well known amongst the men.

The *Foreman* having given confirmatory evidence, added that while he was looking for another man he found defendant in a public-house, and asked him if he was going back, and he gave an answer in the negative. By defendant's absence, and calling in a strange man, all the "draws" were thrown back, and loss of gas was the consequence.

Mr. *Broadberry* said there was no desire to press the case severely against defendant, but where 60 men were employed it became necessary that regulations should be properly carried out.

The BENCH ordered defendant to pay 20s. and costs within a week.

DESTRUCTION OF A GASHOLDER AT FLEETWOOD.—On the afternoon of Wednesday, the 15th inst., a new gasholder lately put up by the Fleetwood Gas Company, came down a complete wreck. It seems that a leak had started in the cast-iron tank, and before this damage could be stopped the tank gave way, bringing down the columns and holder with a run, smashing up everything. Fortunately no injury was sustained by any of the men engaged at the time in the work of repair, as the holder tilted over in the opposite direction to that at which they stood. The loss to the company is serious, but, beyond being in a state of darkness the following night, no inconvenience has been felt in the town.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

LAMBETH WATER-WORKS COMPANY.

The following is the report of the directors to be presented at the half-yearly meeting this day:—

The present ordinary half-yearly meeting of the company of proprietors of Lambeth Water-Works, is held for the purpose of receiving the accounts of the company for the half year ended Sept. 30, 1876, and for the declaration of a dividend for that period, payable in January next.

The directors submit to the proprietors the accounts for the half year ended Sept. 30, 1876, certified as being correct by the auditor appointed by the Board of Trade under the Metropolis Water Act, 1871, and by the company's auditors.

1460 houses and other supplies of water have been laid on to the company's works in the half year ending Sept. 30, 1876, at a rental of £2805 per annum.

Bonds of the company, to the amount of £19,535, became due on the first of the present month, of which £1400 were paid off, and the remainder, £18,135, were renewed at 4½ per cent., being a reduction of one-quarter per cent. per annum, leaving the bond debt at the sum of £197,365.

By the company's Act of 1856 the power to issue share capital would have lapsed on the 5th day of June, 1876, and it therefore became the duty of your directors to issue the £100,000 unissued capital authorized by that statute before that day. If the issue had been made at a premium, the full amount of the premium would have been deducted from the £100,000, and most complicated accounts would have been the result. The directors, with the full approval of the shareholders, determined to issue, and did issue the whole £100,000, at par. The large number of shareholders (about 800) and the varying amount of their holdings (from £25 to £21,375) caused some little difficulty in making the allotment exactly proportionate to the interest of each shareholder, and necessitated the offer at the rate of about two £1 nominal shares for each quarter (or £25) share. But, as the company have no £1 shares, the odd amounts over a multiple of £25 would have been left without dividend, and shareholders were invited to yield up those amounts for consolidation purposes. This operation was effected by your secretary taking the odd amounts, sending 3s. per £1 share as value to those who yielded up the odd £1 shares, and receiving 3s. per £1 share from those who required odd £1 shares to make up a quarter (£25) share. The result has been that £99,250, out of £100,000 in whole, half, and quarter shares have been placed, and only £750, on which your secretary has paid £109 4s., remain in his hands to complete that most desirable result—viz., the placing of the full £100,000 at par, authorized to be issued by the Act of 1856.

After the issue, and before the actual allotment of the £100,000, it was found that about £10,000, offered to trustees and others, could not be placed, and your directors, in order not to break the principle of allotment at par, invited the whole of the shareholders by a circular letter of the 5th of July, to apply, if they wished to receive larger allotments than they were entitled to under the circular of the 10th of May. In response, 435 shareholders asked for £260,000. There being only 400 quarter shares to allot, the directors were unable to regard the amounts which each of the 435 shareholders wished to receive, and therefore adopted a method by which they were enabled to give one quarter share, at least, to every holder of £900 and upwards, but to no shareholder, however large his interest, more than four quarter shares. Thus, the very large holders were not favoured, and the division was made, as your directors believe, upon equitable principles. It is scarcely necessary to point out that if £100,000 gave £2 for ever £25 holding, £10,000 would have given 4s. only for every £25 holding, and would have rendered such fractional portions of a quarter share a source of difficulty and complexity in the accounts without any corresponding advantage to the shareholders.

Your directors suggest that the placing of the £750 now in the hands of your secretary, be left to their discretion.

By statement No. 6 of the liabilities and assets (balance-sheet on the 30th September, 1876), there appears for the payment of dividend to be declared this day, the sum of £34,574 5s. 7d., and the directors recommend to the proprietors for their approval a dividend for the half year ended Sept. 30, 1876, at the rate of 6½ per cent. per annum, less the income-tax, which is estimated at £33,053; after the payment of which there will remain a probable balance of £1521 5s. 7d., in aid of the current half year.

With respect to the condition of the works, the engineer reports as follows:—

"The additional pumping-engine, mentioned in the last report as being ordered and in course of erection at Brixton, is so far finished that it might, if necessary, be brought into use in January next. Seeing, however, that it is at present intended only as a reserve of power, to meet the rapidly extending requirements of the high-level district, it will not be wanted to do much work before next summer, the late extensions of engine-power being sufficient to meet all present demands.

"All the large pumping mains leading from the new engines at Brixton to the high-level district, have also been finished, and are now in operation.

"The covered reservoir in course of construction on Crown Hill, Norwood, is progressing rapidly, and is expected to be completed and brought into operation early next spring. This reservoir will be found of great benefit in the supply of the upper levels between Selhurst and Rock Hill reservoirs, the latter of which has become insufficient for the large draught required from it.

"These works will complete the extensions of the Brixton pumping-station at present contemplated, and will, it is anticipated, suffice for some years to come. But as the growth of this part of London still continues at a rapid rate, the population being of a class demanding a large water supply, it is difficult to forecast, beyond a year or two, how long the present extensions of the works will suffice.

"The works at Ditton and Molesey continue to supply water abundant in quantity and of good quality, and the whole of the reservoirs and works are in an efficient state of repair and good working condition."

Your directors have received from their secretary (Mr. W. S. Phipps), a written request to be allowed to retire from his office after a service of 36 years from May, 1840, and at the age of 79.

It is impossible, in a few words, to point out the value of the secretary's lengthened services, but your directors suggest to show the company's appreciation of these services, the salary of Mr. Phipps be continued as a retiring allowance from the 1st of January next, and he be allowed the occupation of the house until Lady-day next.

Your directors have resolved to advertise for candidates to fill the vacant office, at a salary of £650 a year, with a residence, &c., and will use their best endeavours to select a gentleman of experience and ability, who will advance the interests of the company.

Major Bolton reports that the water in the river Thames at Hampton, Molesey, and Sunbury (where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, Chelsea, and East London Companies are situated), was good on 17 days and turbid during the other days of the month of October. The highest flood state of the river was one foot above the (six feet) summer level, and the lowest was at summer level. The highest temperature of the water taken at Seething Wells was 59°, and the lowest 48°, while the highest temperature of the air at the same place was 68°, and the lowest 38°. The condition of the water in the river was good on nine days, indifferent on 20 days, and bad on three days. These observations were made daily at nine a.m. The rainfall for the month was 1·80 inches.

HORNCASTLE GAS ARBITRATION.

WEDNESDAY, SEPT. 27.

(*Before Mr.* ALFRED PENNY, C.E., *Umpire; and Messrs.* R. P. SPICE, C.E., *and* G. W. STEVENSON, C.E., *Arbitrators.*)

Mr. GRANVILLE SOMERSET, Q.C., appeared on behalf of the Horncastle Local Board, and Mr. P. TAYLOR for the Horncastle Gas Company.

This was an inquiry, under the Horncastle Gas Act of last session, to assess the value of the Horncastle Gas-Works on their transfer to the local board.

Mr. TAYLOR said he proposed to hand in the account of the gas company, which was the same as that produced before the parliamentary committee, with the exception that there were some technical amendments.

Mr. SOMERSET thought the proper course would be for the original account to be handed in.

Mr. TAYLOR said the account now produced was the one upon which he proposed to proceed.

Mr. SOMERSET said he objected to that most strongly. A certain account had been sent to the local board, and his friend now said that was not the account which he proposed to hand in. By the 6th section of the Horncastle Gas Act, the company were bound to send in an account within 14 days of that Act receiving the Royal Assent, which was upon the 13th of July last; therefore they were bound to send in any account they might think fit to proceed upon within 14 days of that time, and any account after that could not be received or gone into by the arbitrators. Upon those grounds he objected to it. The consideration which the local board were to pay was whatever the divisible profits might be shown to be in 1875 at 16¾ years purchase. The Act said the company were to send in an account within 14 days, and that account could alone be dealt with for the purpose of deciding the question; and, furthermore, it was the only account which the local board had the slightest opportunity of testing.

Mr. TAYLOR said his friend was arguing in a manner which he considered to be rather in his favour. The very essence of the matter was to determine equitably and fairly between the parties what was 16¾ years purchase of the divisible profits of the company for the year ending December, 1875, and for that purpose the arbitrators must have proper and equitable premises upon which to base their conclusions. The account which had been delivered had been unfortunately prepared by the secretary of the company, who was not a professional accountant, versed in these matters, and, consequently, although the figures in the account were absolutely correct, and absolutely borne out in that account, yet in consequence of certain technicalities with which the secretary was not acquainted, the figures had been treated in a way in which they should not have been, and, therefore, the results appeared different from what otherwise would have been the case. They had, therefore, thought it necessary to have an accountant from London thoroughly versed in these matters.

The UMPIRE inquired of Mr. Taylor whether he intended to refrain from putting in the paper which had been delivered to the local board. He said he did not think it could be withdrawn from the notice of the arbitrators, because it had been absolutely delivered to the local board.

Mr. TAYLOR said he was not anxious to withdraw it. What he said was that the account now handed in was a correct and proper account, which would enable them to arrive at a proper conclusion. Taking a common sense view of the matter, what the umpire had to do was to deal out fair justice between the parties, and he (Mr. Taylor) asserted that with an incomplete account that could not be done.

Mr. SOMERSET said he ventured to submit that it was imperative upon the umpire to reject any account which was not delivered within the 14 days. The gentleman who made out the account was the secretary, cashier, and accountant of the partnership. He was the only person who knew anything about the money matters of the concern, and now they were told he really knew nothing about it.

Mr. TAYLOR: We simply say Mr. Boulton is not a gas accountant.

Mr. SOMERSET said that his clients had not seen the account which his friend was now purposing to put in, and therefore how could they test it? It must be recollected that the evidence in the House of Commons showed that these gentlemen kept no accounts, and Parliament, knowing that, said, "You shall pay a certain sum—16¾ of the divisible profits, whatever that may be, of 1875;" and they said, further, "These people shall not come again and say they have kept no accounts. They shall send in an account by which they shall be bound to stand." Who could read the clause and entertain any doubt about it? He would not go further upon the point, except to this extent—that the very time to be inserted in the clause for the delivery of those accounts, and the powers the local board should have for testing them, were matters of serious consideration and discussion before the committee of the House of Commons.

Mr. TAYLOR contended that if, owing to certain technicalities, the figures which had been rendered to the local board were incorrect, it was imperative that they should be corrected before the account was laid before the arbitrators to decide what the 16¾ years purchase was. It was stated that Mr. Boulton knew all about the monetary transactions of the company. So he did; but he (Mr. Taylor) said Mr. Boulton was not sufficiently versed in technicalities and the necessary details for preparing a balance-sheet for a gas company upon which an arbitration should proceed, and therefore it was absolutely imperative upon him that he should call in skilled assistance, which had been done. It was not desired to foist anything upon the local board that was incorrect, or for the company to obtain anything they were not entitled to.

The UMPIRE: The decision I come to is this: The groundwork of what we are about is this account which I hold in my hand. I shall assume these sections were very carefully considered by both sides before they were made to form a part of the Act, and it is very clear that the account was to be delivered within fourteen days. This is not an ordinary arbitration under the Lands Clauses Act, but it is here very clearly defined what is to be done; and I shall rule that the accounts provided to be sent in under this Act are the accounts which I shall have to deal with. You can bring, of course, what evidence you please to bear on any minor points, but the accounts that were sent in, as provided by the Act, are the accounts that I must have placed in my hands.

Mr. SOMERSET said he would briefly lay before the arbitrators the story of the origin of the partnership, because something might probably turn upon it. In the year 1854, six gentlemen thought it advisable to supply Horncastle with gas, and a capital was raised of £3000, in 60 shares of £50 each, but no accounts were kept. In 1856 the secretary died, and up to that period everything was in oblivion, excepting the important fact that they had paid good dividends, and had saved £3000. The late secretary was succeeded by Mr. Boulton. He was a gentleman who knew everything about the company; but he also had kept no accounts.

Mr. TAYLOR said that was not quite so.

Mr. SOMERSET said Serjeant Sargood cross-examined Mr. Boulton for a very long time in search of accounts, but he obtained none. A coal book and one or two others were produced, but no such thing as an account. It appeared, however, so far clear that £3000 was saved up to 1856, which was capitalized, and they called their capital £6000. They also claimed to have saved since that time £5000 more, besides paying very good dividends upon the original £3000; though, of course, out of caution they put that dividend upon the £6000 and not the original £3000, so that before the committee it appeared they only paid 4½ per cent., when in fact they were paying 9 per cent.; and only paying 9 per cent. when in fact they were paying 18 per cent. In 1875 they thought it advisable to apply to Parliament, and they promoted a bill to the effect that they were to capitalize the £5000, making, together with the £3000, £8000, and with the other £3000, £11,000, and they were to get upon that 10 per cent., if they could. Their price was to be 6s. 3d., and they also wished to raise further moneys; but in that they were unsuccessful. Lord Redesdale naturally looked into the matter, and he said, "We see no signs of this £5000; it may be real, or it may not. You shall not have 10 per cent., but you may go for 5 per cent. if you like;" and so the bill originally stood that they were to have 10 per cent. upon the original capital of £3000, and 5 per cent. upon the £8000. The application to Parliament was opposed by the local board, who objected to their price and to their finance generally. What might be in the minds of a committee no counsel had the right to speculate upon; but after Serjeant Sargood had addressed the committee for the opposition, the room was cleared, and whilst the parties were outside the room they came to a sort of arrangement. The calculation was agreed upon at 16¾ years purchase upon the figures given by Mr. Boulton and Mr. Dixon. He (Mr. Somerset) might remind the arbitrators that it was the interest of the company to make their expenditure appear as great as possible, and the profits as little as possible, because the great opposition was upon those points, that they were earning too much and charging too much—in fact, doing all sorts of other things that the inhabitants objected to. In the appendix put in by Mr. Boulton, showing the divisible profits in 1875, there appeared the sum of £540; and if that were multiplied by 16¾, it would give, in round figures, £9000. The local board believed those figures to be accurate, as they could not suppose that gentlemen like Mr. Boulton, who for 20 years had had the management of the finances of the company, and Mr. Dixon, a man of considerable ability, could have made a mistake; but from what his friend had said, he (Mr. Somerset) apprehended that those two gentlemen were going to contradict the evidence upon which that arrangement was made. His clients, however, did not wish to be hard upon the company, and thinking they might have made a little mistake, or that they might have had some extra expenses, and so forth, they offered them £12,000.

The UMPIRE: I do not know whether you are going to contend that £540 is to be the basis of the estimate of value; because, if so, we need not be sitting here.

Mr. SOMERSET: I go very near it, but not quite. I am prepared to show that they gave a very different account on the 26th of July to what they gave before the committee.

The UMPIRE: What you wish me to understand is that you were misled by this £540; but that does not really invalidate the fact that I am bound to ascertain these profits.

Mr. SOMERSET said it appeared to him that he must put before the umpire, in some shape, the fact that, whereas the local board thought the company were going to claim £9000, they put forward a claim for £25,000. The original claim, made on the 26th of July, was £22,500; but afterwards a supplemental charge was made for £2500 more, on the ground that certain items were omitted. Of course, that was at once objected to, notice being given to the company that the extra claim of £2500 was perfectly out of their power to make. Time went on, and about a fortnight ago an offer was made by Mr. Boulton——

Mr. TAYLOR: I distinctly deny it.

The UMPIRE: These kind of offers are very well understood as being made without prejudice. Was this made without prejudice?

Mr. SOMERSET: No, it was not made without prejudice. I always think it courteous to ask the counsel on the other side the question, and if he says it was without prejudice, not to prosecute the matter further; but this was not without prejudice, my friend simply denying that the offer was made.

Mr. TAYLOR: There was a conversation without prejudice; but I deny there was any offer made.

Mr. SOMERSET said he should call evidence to prove it. What occurred was that about a fortnight since Mr. Boulton made an offer to the chairman of the local board, Mr. Snartt, to the effect that they were prepared to take £18,000; and that, if Mr. Snartt thought it should be brought before the board, he (Mr. Boulton) wished him to do so, and obtain their reply upon the point—yes or no. Mr. Boulton wished Mr. Snartt distinctly to understand that it was an offer to take £18,000, and if he did not think the board would enter upon any further consideration of the point, he was to keep it to himself, and not say anything further about it. Mr. Snartt would be called and would give evidence on that point. As regarded the offer of £12,000, £8000 at 5 per cent. was £400 a year, and £3000 at 10 per cent. was £300 a year, which together made £700 a year, and that amount multiplied by 16¾ would give something just under £12,000, and therefore that sum was offered to the company, though, of course, the local board were not bound by that offer now. Still it showed that, taken in any way, the company were actually offered all that they could have obtained upon their old capital, and the value of the undertaking supposing the bill had passed. The evidence to be produced would show that the local board were not in any way disposed to treat those gentlemen in a niggardly spirit, when they offered them all they could possibly have obtained from what they had spent—or, rather, what they said they had spent—during the time they had had the partnership. In conclusion, he (Mr. Somerset) would ask the umpire to believe what appeared in the evidence before the House of Commons; and if so, he believed it would be found that something between £9000 and £10,000, even putting it in excess of their figures, would be the value of the property. He should be able to show that, in their account, they entirely left out anything like deterioration by wear and tear, and many other things which were absolutely necessary in the carrying on of gas-works. He could not help feeling confident that, whatever figure was arrived at, it would not be £25,000, nor £18,000. He was pretty confident about that, and sincerely hoped that he should be able to show that not only a fair, but more than a fair and liberal sum had been offered to those gentlemen.

The following evidence was then called:—

Mr. *Alfred Lass*, examined by Mr. SOMERSET.

I am an accountant, residing in Gracechurch Street. I have had considerable experience with regard to gas companies, and was called in by the Local Board of Horncastle to consider the question now before the arbitrators. I was requested to go into calculations to see what the divisible profits were in 1875, and the following statement was handed to me:—

An Account of Receipts and Disbursements of the Horncastle Gas Company for the Year, Jan. 1 to Dec. 31, 1875, showing Divisible Profits for that Year.

June 30, cash received for—				Dec 31, cash paid for—		
Gas from private consumers	£878	11	4	Coals and carriage	£996	16 7
Meter-rents	50	5	4	Lime	37	9 0
Public lamps	138	0	0	Fire-bricks, retorts, setting, and repairs	62	18 10
Coke and tar to consumers	184	9	4	Salaries—Secretary, Collector, and manager	154	0 0
Coke, &c., sold in yard	51	14	4	Wages to two stokers	130	0 0
Lamp at lock-up	3	0	0	Two lamplighters, 17 weeks	11	18 0
Dec. 30, cash received for—				Rates and taxes	57	15 8
Gas from private consumers	1,179	13	11	Interest, commission, and cheques to bankers	16	15 1
Meter-rents	50	1	10	Other expenses of management, trade bills, and sundries	133	8 4
Public lamps	169	17	9		£1,601	1 6
Coke and tar to consumers	183	15	11	Balance applicable for dividend	1,341	2 3
Coke and tar sold in yard	49	14	0			
	£2,942	3	9		£2,942	3 9

Those are the original accounts. I have carefully considered the evidence given in the House of Commons on the Horncastle Gas Bill. I also went down

to Horncastle and saw Mr. Boulton and Mr. Dixon. The account just now put in differs materially from the one which had been considered by me, and which was given in evidence in the House of Commons. My calculation upon the clause in the Act of Parliament was £9700; but the claim made by the company in the account sent in on July 26th last, was 16¾ years purchase upon £1341 2s. 3d., amounting to £22,351 17s. 6d. I have not had the supplemental account handed to me.

Mr. SOMERSET read the letter containing the supplemental account, which stated that an omission had occurred, in consequence of the delay in taking the meters, of 551,600 cubic feet of gas, for which the company claimed to add £160 17s. 8d. to the divisible profits of 1875.

Mr. TAYLOR: The exact figure, multiplying £160 17s. 8d. by 16⅔, is £2681 7s. 9d.

The UMPIRE: Making altogether £25,033 5s. 3d.

In reply to Mr. SOMERSET, the UMPIRE said his impression was that that supplementary document should be taken no notice of at present, although he did not know whether anything he might see or find afterwards might disturb that impression.

Mr. SOMERSET: In that case I will not go into it, but will suppose it has never been written. (To witness:) Will you tell the arbitrators how you reduce that figure of £22,500 to the amount you have put before them. I will take, first of all, the coal. At what do you put the coal; that is, taking the quantity carbonized in 1875?

Witness: The quantity of coal bought in 1875 was 1166 tons, but according to the coal book kept by Mr. Dixon, the quantity carbonized was 1015 tons. I made inquiries with respect to the stock in hand on the 31st of December, 1874, and was informed that no account had been kept, but it was believed to be about the same at the commencement of the year as at the end of the year. That would show that the 1155 tons had been not only bought, but carbonized. The gas made per ton of coal was 9300 feet, and gas sold 8653. The total quantity of gas made was 9,437,000 feet, and 8,783,000 of that was sold. The 9300 feet per ton was calculated upon the 1015 tons, making the calculation upon the 1166 tons, it would work out to 8094 feet made, and 7556 sold, which would make a great difference in expense. The average price of coal last year was 22s. per ton at the railway, with an addition of 1s. 3d. for hauling and trimming. The 1015 tons multiplied by 23s. 3d. amounts to £1779 18s. 9d., but if the 150 tons are added to that, it will amount to about £165 or £170 more.

The UMPIRE: The evidence goes to show that there was in reality a larger quantity of coal used than was stated before the committee.

Mr. SOMERSET: Yes; and the witness was informed of that by Mr. Boulton and Mr. Dixon, which, perhaps, those gentlemen may say is a mistake.

Examination continued: I was bound, in the first place, to take the evidence I found, and which I believed to be accurate. In the account of the company of July 26, a very different class of coal and a very different price is given from that stated before the committee, where it was said to be 23s. 3d., while in the July account it is put down at 17s. 1d. Taking the coal question alone, as to the difference in quantity and the difference in price, the account given in July is between £5000 and £6000 in their favour, as against the account given before the House of Commons. In the accounts presented by the company there is next to nothing charged for maintenance of buildings, retorts, mains, services, meters, &c. There is a sum of £62 18s. 10d. for fire-bricks, retorts, settings, and so on, and there may be some other items mixed up in the last item of £133 8s. 4d., for "other expenses of management, trade bills, and sundries." The account of July 26 gives a balance of profit of £1341 2s. 3d., which has to be multiplied, and comes up to the figure mentioned of £22,500; but there are a number of matters not mentioned in that account, which, in my opinion, ought to reduce it very considerably. The first is "Cost of renewing 5 burnt-out retorts, at £8 each; 7 retorts only renewed instead of 12." I put that down at £40. Usually the company have renewed one bed of 7 retorts and one bed of 5; but in 1875 only one bed of 7 was renewed. The next item is "cost of renewing the following meters," for which nothing is allowed, although the meters which have been fixed for renewals should be charged against the revenue account for the year. I am informed that three 3-light meters, three 5-light meters, and one 10-light meter, were so fixed for renewals, the cost of which would come to £12 10s. 6d. The next item is the cost of renewing one 14-inch lamp, 17s. 9d., which should go to revenue, no doubt. The next item is, "Renewing 120 yards of 1½-inch main with 3-inch," and I therefore charge the original cost of 120 yards of 1½-inch main, which I put down at £14. The next item is, "Salary to manager, £104," included in the account furnished by the gas company, and I have put down £150 as being a proper sum to charge. I may say that my opinion has been partially confirmed by the following:—I believe that Mr. Dixon had applied for an increase in salary, and that the gas company had promised, supposing the bill had been passed, to increase his salary to £150. I am also informed that the local board have agreed to pay him £150; which makes a difference of £46. The salary of the secretary, £25, included in the account, I have put down at £50, as the proper sum to be charged, in my opinion; but I do not think the local board would be able to get the secretarial office discharged under £150 a year. The collector is also put down at a salary of £25; but I believe Mr. Wright, as well as Mr. Boulton, has an interest in the concern. I have thought it right to charge a per centage of 1½ for collection on the private rental, as being a fair and equitable charge, which would come to £30 18s., for which they have allowed £25, and I seek to charge an additional £5 18s. With regard to the bad debts, I find there is nothing charged, and I think, as a strict matter of principle, certainly something should be allowed for bad debts which must necessarily arise in carrying on the business, so that I seek to charge one per cent. on £2065. I was informed that two bad debts had actually occurred in 1875—one of £4 10s. 7d., the other 15s. With regard to the interest on floating capital, Mr. Stevenson, in his evidence, put the floating capital at £700, and I have assumed that 5 per cent. should be allowed on that, which comes to £35; and then the company have charged in their account a sum for interest on overdrawn account, so that I give them £7 5s. 1d. With regard to the insurance of buildings, in my opinion buildings should be insured, and I do not find any charge in the company's accounts for the insurance. I have taken the value of the buildings at £3830, as given by Mr. Stevenson in his evidence, to which he adds the 5 per cent. I have also added 5 per cent. on the £3830, which makes it £4021, and I have taken the insurance on that amount. That charge simply applies to the buildings. I do not find anything allowed by the accounts for depreciation of meters. In many companies, I believe, 10 per cent. is charged on the value of the meters for depreciation. I usually take 10 per cent. myself, but in this case I have only taken 7½ per cent. on £800, which I have estimated as the value of the meters, and which amounts to £60. Mr. Stevenson, in his evidence, gave the structural valuation as follows:—Value of the land, £800; buildings, £3830; plant, apparatus, and works, £4940; mains, services, and meters, £3732; stock-in-trade, £400; and engineer's commission, £532; but it would not be right for me to take 1 per cent. for depreciation on the whole of that, and I have left out the stock-in-trade and the £800 for meters, upon which I seek to charge a special depreciation; so that I take 1 per cent. on £12,234. Calculated in the way I have mentioned, that item works out to £122 6s. 9d. Putting all the items together, they amount to £733 13s. 1d., which, subtracted from £1341 2s. 3d., leaves £607 9s. 2d.; and that amount, multiplied by 16¾, amounts to £10,124 6s. 1d. There are also some further deductions, which are special items, and ought to be taken off the gross amount of £10,124 6s. 1d. I am informed that the seven retorts which were renewed during the year 1875 were not so bad as to compel the renewal thereof in 1876. The consequence is that, supposing the works are handed over to the local board, there will be a charge in the accounts of 1875, for renewing seven retorts, which should not appear there; and I think it only right that some relief should be claimed by the Horncastle Local Board for this additional charge, which would not appear under ordinary circumstances. I put that down as £56—seven retorts at £8. On reference to Mr. Stevenson's evidence, I find he says the scrubber is to be lengthened out for a certain purpose; and, on making inquiries, I found they were erecting a new governor. The old governor, when pulled down, will certainly be a charge, or some portion of it will be a charge, against the revenue account; and, as far as the old gasholder is concerned, it is in a dilapidated condition, and will require some amount of money to be spent upon it. Altogether, that has been estimated at £300; so that there is a sum of £356 to be deducted from £10,124, which leaves a net amount of £9768.

Cross-examined by Mr. TAYLOR: With regard to the retorts, I take the same price as Mr. Steveuson—£8 per retort. With regard to the meters, I take the price list. With regard to the 14 inch lamp, I take the price absolutely in the bill. With regard to the £14 for renewing the 120 yards of main, I take the price list. For the 1½-inch main, 1s. 2d. per foot, less discount, 8d., which left 6d. per foot; and a charge of 10d. per yard for laying, which gives an average price of 2s. 4d. per foot.

The UMPIRE: Is that the kind of answer you are expecting?

Mr. TAYLOR: Yes.

Cross-examination resumed: With regard to the coals, the 1166 tons represent the number of tons actually carbonized; the 23s. 6d. I took from the invoice itself. I went to Horncastle for the purpose of examining the accounts, and ascertaining what the divisible profits were.

Mr. TAYLOR: Did you find anything like 23s. 3d. a ton in the books?

Witness: Certainly not; I found 17s. 1d.

Mr. TAYLOR: Then you say you have based your calculation on the evidence given in the House of Commons?

Witness: I considered that the Horncastle Local Board were entitled to some relief, and in the evidence it is put down that 1015 tons of coal were carbonized, and that the price which is absolutely sworn to was 23s. 3d.; and upon that the local board based their calculation. I found on going through the accounts at Horncastle that the price was only 17s. 1d. per ton, and I charge £388 12s. 11d. the difference between the 23s. 3d. and the 17s. 1d. a ton, as against the Horncastle Gas Company.

Mr. TAYLOR: Then, basing your calculation upon figures which were elicited before the committee, and which you ascertained to be incorrect upon reference to the books, do you consider that a way of arriving at the divisible profits of 1875?

Witness: I consider the way I have endeavoured to arrive at the divisible profits is the right way, and I simply claim this as a relief.

Mr. TAYLOR: Do you consider it to be a right thing to take a wrong figure, knowing it to be wrong?

Witness: I took the 23s. 3d. as given in the evidence.

Mr. SOMERSET objected to the line of cross-examination, unless Mr. Boulton was going to be called.

After some discussion, the UMPIRE said he did not think he would withdraw the questions from the arbitrators, as the local board had employed an accountant to go down and examine the books, and he was stating what he found there.

Cross-examination resumed: The way I arrived at the quantity of coal carbonized in 1875 was as follows:—I found in the coal-book that 1166 tons had been bought, and at the end of the memorandum in the coal-book it states—"Deduct 150 tons." If the stock at the end of the year is to be taken, the stock at the commencement of the year must also be taken. I then began to inquire as to the number of tons of coal in stock on Dec. 31, 1874, and I was informed it was about the same as all the other stocks were. They gave me no particulars, only that the stocks were about the same at the commencement as at the end of the year. I am, therefore, left with the quantity of coal bought as being the quantity actually carbonized. I have not in any way mixed up what is generally termed maintenance with what is generally termed depreciation. I have taken Mr. Stevenson's structural value for the depreciation, and the only things I seek to charge to the maintenance account, or the wear and tear account, are the items I have already enumerated. Engineer's commission is undoubtedly included in the structural value.

Mr. TAYLOR: Why did you now follow Mr. Stevenson's rule of taking 1 per cent. all round for depreciation instead of deducting meters?

Witness: I consider that the meters are subject to special wear and tear. A meter wears out in the course of 12 or 13 years, and the works are not supposed to wear out in 60 or 70 years.

Mr. TAYLOR: Do you happen to know upon what principle the allowance of 1 per cent. is made?

Witness: I think it is to meet the requirements of the Gas-Works Clauses Act, 1847, with regard to the reserve-fund.

Mr. TAYLOR: I ask you whether, in the table which is in that Act, there is a single item put down for depreciation?

Witness: Certainly not; but it has to be considered in making up the amount that is put there. Suppose the gas company earn £500, and their statutable dividends come to £509, they would not be justified in dividing the whole of it without in the first place laying by a sum for the reserve-fund.

Mr. TAYLOR: Then you would surreptitiously introduce such an item, if it is not there?

Witness: I do not think it would form a portion of the revenue account.

Mr. TAYLOR: But you have charged it in the revenue account here?

Witness: I seek to make it one of the deductions. Before we say the amount is a divisible amount, we must see what deductions are to be made from it, in order to arrive at the amount of profit which we are justified in stating.

Mr. TAYLOR: Will you point out any parliamentary authority for making a charge for depreciation?

Witness: There is provision made for repairs and maintenance. The first item is, "Coals, including dues, carriage, unloading, and all expenses of depositing same on works; purifying materials, oil, water, and sundries at works; salaries of engineers, including chief engineer (if any), superintendents and officers at works; wages and gratuities at works; repairs and maintenance of works and plant (including renewal of retorts), machines, apparatus, tools, and labour." Now, over and above all that, I believe we are justified in charging for depreciation.

Mr. TAYLOR: Then, do you mean to say that these items are depreciation and not renewals?

Witness: I mean to say that one per cent. is depreciation; the other is for renewals. The other items are for repairs and maintenance of works, which ought to have been charged to the maintenance account. With regard to the charge of £150 for the manager's salary, the local board have already agreed to pay him that amount, and I do not think they would have done so unless they had felt that his services were worth it. I should not think £150 a year a sufficient salary for a secretary and manager too.

Mr. TAYLOR: You say we have put certain things into repair; was not the object in doing so to enable the company to earn a better profit? You have debited us with £300 for putting the governor and scrubber into repair. Would it not be a legitimate expenditure to enable the company, or whoever afterwards carried on the gas-making business, to increase their profits?

Witness: So far as the governor is concerned, it would not tend to increase

the profit at all; but the old governor was too small, and, therefore, they have replaced it with a new one.

Cross-examination continued: I should not like to give an opinion upon what was contemplated by sub-section 8 of the Horncastle Gas Act—"Any question which may arise under this section of this Act shall be referred to and be terminated by Robert Paulson Spice and George Wilson Stevenson, both of the city of Westminster."

Re-examined by Mr. SOMERSET: None of the suggestions which have been made to me have altered my view as to the figures which have been presented to the arbitrators.

The UMPIRE: Do I understand you that, in making up the sum which you say is a proper amount to be charged for coals, you have taken the price at 23s. 3d.?

Witness: In working out the £9700, I sought to charge the difference between the 1166 tons at 23s. 3d., which comes to £1356 9s. 6d., and the amount charged in the company's account, which is £358 12s. 10d.

The UMPIRE: So far as your investigation goes, you found that the cost was 17s. 1d.?

Witness: I am quite positive about that.

The UMPIRE: As regards the quantity consumed, although it has been stated that the quantity carbonized was 1115 tons, you found it 1166; therefore you have corrected the error in one way and not in the other.

Witness: I have taken the 1166 tons in both places.

Mr. STEVENSON: Have you applied the figure which you have ascertained to be the true cost of the coal to the quantity of coal which you have ascertained to have been carbonized—have you, in fact, applied 17s. 1d. to the 1166 tons, or have you applied the 23s. 3d.?

The UMPIRE: That is plain; you know he says 23s. 3d. That is on the notes, and there is no doubt of it. It appears to me that this is a serious question, because, according to the books, it is shown that the coal cost 17s. 1d. per ton, and according to the evidence before the House of Commons, the coal cost 23s. 3d. per ton.

Mr. TAYLOR: I hope I shall be able to clear that up.

Mr. *W. F. Snartt*, examined by Mr. SOMERSET.

I am chairman of the Local Board of Horncastle, having been appointed last month. I was one of the first members of the board elected in 1864, and I therefore know all the matters connected with this contest, and the arrangements afterwards between the local board and the gas company. I was not called as a witness before the committee of the House of Commons, but I was there. I was present in the lobby when the arrangement was made which resulted in the clauses which have been pointed out to the arbitrators. That arrangement was founded upon 16¾ years divisible profits of 1875, on the evidence given before the committee. We believed we had made a very proper bargain; in fact, the gentleman who had the conduct of the case said it was the best bargain he ever knew. We certainly supposed the evidence to be true which had been given by Mr. Boulton, Mr. Dixon, and the gentlemen connected with the company. The following are the circumstances relative to the price to be paid to the company:—On Monday, Sept. 11, I met Mr. Boulton, amongst other gentlemen, at a sale in the town, and I said, "Mr. Boulton, do you think we shall get the affair settled by the 1st of October?" He said, "I do not know;" but, after some more conversation on the same subject, he said, "Do you think we could not arrange it without any more expensive arbitration or expenses whatever?" I said, "In what way do you mean?" "Why," he said, "two or three of us and two or three of the board to meet together, and try and come to terms." I said I thought that was an offer that they would entertain if he could put it at anything like a reasonable figure, and I called one of the board—Mr. Vesey—to listen to the conversation, and it finished up with this, that I should mention this little conversation to some of the Gas Committee, and see Mr. Boulton again in the afternoon of the same day. I saw some of the committee, and after that I went to Mr. Boulton's house, and said, "Now, Mr. Boulton, if you will put down or say the lowest figure you will take, I will call the committee together, and see if we can come to terms without any further expense, for we wish to avoid all further expenses as well as yourselves." He said, "I know the mind of the company, and the price will be £18,000." Previous to that I said that if it was a price I thought the Gas Committee would entertain, would lay it before them; but, if I thought it was a figure they would not entertain, I was perfectly satisfied to keep a secret with himself. But when he put it at £18,000, I thought it was a price that the Gas Committee might fairly be called together to consult upon, and I said, "Be kind enough to put it upon paper," which he did, and gave the paper to me. I went and informed the Gas Committee, and we called a committee meeting the same evening, and it was laid before them, the result being that myself and Mr. Dee, our clerk, should come up to London the following day, to consult with Mr. Spice or Mr. Cooper, but we were informed that Mr. Spice was not at home. We had some conversation with Mr. Cooper the next afternoon, and his advice was that we should not agree to it. After we returned home we had another committee meeting, and it was determined then that we should decline to give the £18,000, and leave the matter to take its course according to the Act of Parliament, and I wrote a note to Mr. Boulton to that effect the next morning.

Mr. BOULTON denied having received any such letter, and a copy of it was ordered to be telegraphed for.

Examination resumed: I subsequently met Mr. Boulton in the market-place on the 18th of September, and told him verbally what I had written before, that we would have nothing more to do with the matter.

Cross-examined by Mr. TAYLOR: We were guided in our conclusion to accept the offer of 16¾ years purchase, by the evidence given on behalf of the company as to divisible profits, and also by the advice we received from Mr. Michael.

Mr. TAYLOR: Will you kindly refer to the evidence, and show us any one place where the divisible profits are mentioned in figures?

Mr. SOMERSET said he was quite ready to admit that the words "divisible profits" did not appear in any part of the evidence.

Mr. TAYLOR (to witness): Were you in the room when Mr. Michael gave his definition, which appears on page 74 of the evidence:—"They divided £540; perhaps they might have divided more; but whatever was the sum really divisible for the year as profits, we agree to give 16¾ years purchase of that sum." Was that, as expressed by your counsel, what the local board intended?

Witness: I believe it was not.

Mr. TAYLOR: I will call attention to the next sentence of Mr. Michael, in reply to Mr. Richards. Mr. Michael says there, "What words could be used except the words 'divisible profits,' which mean all the profits you have earned." Can you show us in any part of this plan all the profits we have earned?

Witness: Certainly not.

Mr. TAYLOR: Then how can you mean to say, that being the case after your counsel's explanation, you were guided by the dividend of £540 in arriving at a conclusion?

Witness: That was our impression, and that was the basis upon which we worked.

Cross-examination continued: I did not look upon my conversation with Mr. Boulton as a private one and privileged. I did not consider the figure quoted by that gentleman to be a definite figure. Certainly, I should not have laid it before the committee unless I had thought it was a reasonable offer; but I thought we might further negotiate upon it, and get it for considerably less. I do not know if any minute was made at the committee meeting on the 11th of September. I have never communicated officially with the gas company myself except upon this one question.

Mr. SPICE: I should like to ask whether you, or those who advised you in the corridor of the House of Commons, had any other data to go upon than the declared dividend—the dividend which had been shown to have been paid by the Horncastle Gas Company—as to what the property might come to? Had you any other information or knowledge of any other kind whatever than that which had been given in evidence?

Witness: No; not the least in the world.

Mr. SPICE: If you had had any evidence, or had had any information supplied to you, that the profits would have amounted to about £1500, instead of £540, would you have listened to anybody's advice who might have advised you to give 16¾ years purchase on such a sum for the works in such a town as Horncastle?

Witness: Certainly not.

Mr. SPICE: I ask the question because I was with Mr. Michael in the case, and had something to do with advising you; and I ask this: Did we not say we would allow a fair margin between £540 and whatever the profits might be? I do not care whether the profits were £600 or £700. Did you weigh such figures as £700 in your mind as a maximum?

Witness: I remember the conversation respecting this £540, and some one suggested it might be £700 or £640, and Mr. Michael said, "Well, that will only add £40 a year more."

Mr. SPICE: I only wish that point to be cleared up, that the evidence which was given was weighed by Mr. Michael and myself, as advisers of the company, and we considered that 23s. 3d. was a very stupid price for the company to give for coals, and we estimated that a large profit would accrue to the local board if they went to market in a proper way. These things did weigh with the representatives of the local board in the corridor of the House of Commons. Perhaps I should not have put it in this way, because it looks like giving evidence; but I was only seeking to establish the broad fact before the umpire, that the evidence which was given was all the parties had to enable them to come to a conclusion as to whether it was wise and proper to put themselves in the position in which they ultimately did place themselves.

Mr. STEVENSON: The principle of the purchase being determined—viz., 16¾ years of the divisible profits, whatever they might be, entitled you to enter at 6 per cent. profit, so as to realize that 6 per cent. Would it make any difference to you at all whether the annual profit was £540 or £1540? I am only suggesting to you that in one case you would get 6 per cent. dividend on £540, capitalized on 16¾ years purchase, and in the second place you would get 6 per cent. dividend the first year on £1540 capitalized in the same way. The only question I wish to put to you is, does not the principle govern the question and not the amount?

Witness: To a certain extent.

In reply to Mr. SOMERSET, the UMPIRE said that if the question to be decided was whether £18,000 would be a proper sum or not, there would be no need to go on with the inquiry, and he thought it unnecessary to waste further time over the proposal made by Mr. Boulton.

(To be continued.)

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders was held at the Company's Office, No. 30, Gracechurch Street, London, on Tuesday, Nov. 21—T. HUGHES, Esq., Q.C., in the chair.

The SECRETARY (Mr. Alfred Lass) read the notice convening the meeting, the following report and statement of accounts were presented:—

The board have to report that the revenue account for the half year ending June 30, 1876, shows a profit of £899 4s. 1½d. They regret, however, to state that in consequence of irregularities in dealing with the rental, and incorrect returns as to the amount of stocks, by their late manager, losses have been incurred which will prevent their advising the declaration of a dividend for the last half year. These irregularities have compelled the board to dismiss the late manager.

They have to add that the new gasholder has been erected by the late manager, without reference to the detailed plans sent by the company's engineer, and it has consequently shown a settlement in the foundations, and the columns have been broken. To remedy these defects the board thought it necessary to send out an experienced engineer, Mr. C. Gandon, who would at the same time examine and report upon the state of the works, and the general business of the company. Mr. Gandon has returned, and reports the gasholder to be now in good working order; he has also reported on the works and working, which report can be inspected by any shareholder at the offices of the company.

A new manager has been appointed, and has arrived at Georgetown.

The deficiency account, so far as it can be at present ascertained, amounts to £939 15s. 3d. The board, therefore, propose to write off this sum at once, leaving the sum of £10 1s. 7d. to be carried forward to the credit of the next half year's account.

They have also to report that Mr. A. W. Perot, one of the directors at Georgetown, has resigned his seat at the board.

Dr. *Balance-Sheet, June 30, 1876.* *Cr.*

Share capital—				Fixed plant, mains, and services, as per last account	£32,391	8	11½
6200 shares, at £5, fully paid up	£31,000	0	0	Add since expended	757	12	4
Preference shares	970	0	0	Stock in hand	2,860	13	9
Debenture bonds	6,400	0	0	Cash at bank and in hand	1991	8	7½
Retort renewal-fund account	84	3	8	Bills receivable	1,775	0	0
Bad-debt fund	50	15	0	Amounts owing by sundry persons	2,344	2	9½
Bills payable	2,354	18	11				
Amounts owing to sundry persons	1,218	16	10				
Suspense account	31	10	5½				
Profit and loss account—net revenue	10	1	7				
	£42,120	6	5½		£42,120	6	5½

Revenue Account, June 30, 1876.

Coals and bitumen	£962	5	8	Gas and rental of meters	£3,193	12	7
Purifying account	25	15	6	Residual products and fittings, &c.	343	5	4¼
Wages account	368	15	7				
Repair and maintenance of works, plant, &c.	160	15	7				
Salaries	705	4	2				
Rent, rates, and taxes	122	8	11½				
Directors and auditors fees	155	5	0				
Trade and general charges	61	1	4½				
Bad debts and allowances	68	18	5½				
Law charges	7	3	6				
	£2,637	13	9½				
Balance, carried to profit and loss, net revenue	899	4	1¾				
	£3,536	17	11¼		£3,536	17	11¼

Profit and Loss Account (Net Revenue), June 30, 1876.

Dividend, &c., paid to shareholders to Dec. 31, 1875	£782	1	0	Jan. 1. Balance brought from last account	£1,082	9	11¼
Interest on loans, debentures &c., to June 30, 1876	249	16	3	June 30. Revenue account—Balance brought down	899	4	1¾
Suspense deficiency account	939	15	3				
Balance carried forward to the next half year's account	10	1	7				
	£1,981	14	1		£1,981	14	1

The CHAIRMAN: Gentlemen,—I have now to move—"That the report and accounts be received and adopted." Of course, the matter which presses upon us to-day is what has happened in Georgetown since the last time the board met the shareholders. Within a few days after that meeting we received intelligence of a very startling and unsatisfactory kind from Georgetown. We were informed that charges of a very serious description had been made against our manager at Georgetown before the local committee, in reference to his conduct of the business of the company. The directors, after taking the matter into their most serious consideration, determined to send out an independent and perfectly reliable engineer, in order to report upon the state of things in Georgetown, and as to the condition of the new works of the company, which were declared to be in a disastrous state. I should say that the charges made against him were entirely denied by the manager, and we felt that, having the positive statements on the one hand, and their absolute contradiction on the other, the only way to satisfy ourselves and the shareholders, was to send over a person of well-known reputation in England to examine into, and inform us precisely as to, the actual state of things. Accordingly, on the 26th of June, we resolved to send out Mr. Gandon for that purpose. I need not go into all the particulars, but may state at once the result of his examination, because, as far as details are concerned, we have Mr. Gandon here to-day to answer any inquiry. We thought it advisable, as he has returned from the colony, that we should invite him to meet the shareholders on this occasion, that he might lay before you all the information you may desire as to the condition of your property in Georgetown, and as to the future prospects of the undertaking. However, to take up the thread of my narrative, I may say that Mr. Gandon had scarcely been there more than a few days when he was able to telegraph to us that, as to the accusations, there was a great deal of foundation for them. Of course he could not tell in detail at once how far these accusations might prove true; but what he telegraphed to us was sufficient to induce us at once to dismiss the manager and appoint another in his place. When Mr. Gandon had had time thoroughly to go into the examination of the state of things at Georgetown, the result appeared to be as follows:—He reported to us a deficiency in the coal store of 331 tons 12 cwt. The carbonizing returns, up to the 30th of June last, gave as the amount of coal in stock, 481 tons. Upon that return, but for the matter having been detected and the examination made by Mr. Gandon, the present balance-sheet would have been founded. Unfortunate, therefore, as the result is, so far as your immediate dividend goes, it is very fortunate that what has taken place took place at the time, and that we have thus been able to inquire thoroughly into the matter to the very bottom, so as to know entirely what loss the company have sustained. The stock was weighed by a sworn weigher, and it was found to be 149 tons instead of 481, showing a deficiency of upwards of 331 tons. That alone amounted to £551 5s. 8d. There were also 100 tons of bitumen wanting in the quantity which had been returned to us, and this represented a further loss of £142 10s. Of course, the shareholders have a perfect right to say, "How did this happen? Were all proper precautions taken to keep the board at home informed of the state of affairs at Georgetown, and what measures were adopted in order that nothing of this kind should occur at the works?" Well, from the first the difficulty was foreseen that uncontrolled management at such a distance from England must of necessity be very dangerous, and to meet that danger it was resolved, at the institution of the company, to appoint a local committee, with a local secretary, who would be able to exercise personal supervision over these matters, and make every necessary arrangement on the spot for the conduct of our business. Accordingly, a local board were appointed, and a local secretary, and the board at home naturally thought that the returns made to them from month to month—and which are most carefully looked into here—underwent the same amount of careful examination in Georgetown, and that no return would be made which had not received practically the sanction of the committee there. But no information was ever received from the local committee bearing on this matter until the disclosures to which I have adverted were made in June last. It has been, as you may suppose, a subject of great anxiety and mortification to the board at home that such a state of things should be possible. It is astonishing to them that the carbonizing returns should have been made to them month by month—indeed, they cannot believe they were made in ignorance of the real condition of affairs. It might be possible that a small amount, of perhaps 40 or 50 tons of coal, should be misreported, because it is not easy, without accurate measurement, to know whether a stock of coal represents exactly what it is supposed to do; but in reference to so large a deficiency, we cannot help feeling that it must have been known to the manager for months—probably years—beforehand. Mr. Gandon will give you his opinion about it, and he will tell you also what he thinks of the manager we have sent out to succeed the late manager. We believe that he is a man who is very competent, and who will make a very able manager. And we have now a great advantage which we have not had before, and which we think will make it quite impossible that such a thing as we have now to regret should occur again. You have heard that Mr. Quintin Hogg has consented to come on the board of this company. Mr. Hogg is the proprietor of very large sugar-works, situated almost next to our works, and he has a very able staff there. Two of his principal men superintended the measurement of our coal during the recent investigation by Mr. Gandon. Fortunately Mr. Hogg is out in Georgetown every year for a certain number of weeks or months, as the case may be, so that we shall be able to keep a watch, through him, over the state of things at our works. There is only one other matter to which I need refer. It was stated at the time when advices came to us in July last, that our new works were, as regards the gasholder, in a very unsatisfactory condition, and that great expense would be necessary to put them in order. I am happy to say that we learn from Mr. Gandon that these new works, with what he was able to do to them before he left the colony, are now in good condition, and in satisfactory operation. He will tell you that the prospects of the company are very good, and that the consumption of gas will considerably increase. I have nothing further to add, except this—that one of the Georgetown directors, Mr. A. W. Perot, having resigned his seat at the board, the directors here (subject, of course, to your approval) are decidedly of opinion that it is not necessary to appoint a successor. There is one gentleman on that board, Mr. R. P. Drysdale, who has had his attention called very pointedly to his duty in supervising the works. I may, in conclusion, just say that with reference to the actual loss the company have sustained, I gave the loss on the coal deficiency only £693 15s. 8d.; the balance is made up partly by a sum which Mr. Blanchett had had in advance, and which there is no prospect, I fear, of our ever being able to recover, and partly also by certain irregularities in the rental, which, however, are practically small, and need not be detailed. These further items bring up the total loss to the £939 mentioned in the report.

The DEPUTY-CHAIRMAN (Mr. H. P. Stephenson) seconded the motion.

Mr. STOKES asked that, in making his statement to the meeting, Mr. Gandon would inform the shareholders as to the state of the gasholders, and how the city was lighted up.

Mr. GANDON: Gentlemen, the chairman has given you the particulars with reference to the complaints made as to the management of affairs in Georgetown, so that I do not think it necessary to enter into all the details as to the deficiency in the stock of coal, &c., except to say that it undoubtedly appeared to me that this deficiency had been an accumulating one, which had been going on from the commencement. That any coal has been made use of improperly I do not think there is the slightest reason to suppose. Probably the accounts from time to time have been made too favourable, and thus the deficiency has increased. I found but little to complain of in the works when I arrived there. They were laid out too economically at first, more especially with regard to the storeage of coal, but still the buildings and apparatus I found in good condition. The retorts were not set so well as they should have been, but the results obtained from them were, comparatively speaking, very good. The great fault was in the new gasholder. The foundations had not been carried out by the late manager according to the plans furnished to him by the company's engineer in England, Mr. Alfred Williams, and, consequently, there had been a settlement and a breaking of columns. The tank, too, was out of the level nearly 4½ inches, but I did not think it necessary to go to the expense of reinstating it. I restored the columns which had been broken by the settlement, and after watching for two months very carefully, I did not find that any further settlement had taken place. When I left Georgetown the holder was working very satisfactorily, and the last news, on the 25th of October, was that it continued in the same state. I think, therefore, there is no reason to apprehend any further danger. It is just possible that in the rainy season a settlement may occur; but I do not think it likely, because with the former holder there was a settlement of two inches which has not gone any further. As to the lighting of the town, I must say it is very good, the gas averaging 14 or 15 candles. No complaints are made in this respect. The great complaint arises from the price charged to private consumers, and it would be desirable, if possible, to reduce it, because kerosine is sold so cheap that people will use it while the price of gas is high. I think the prospects of the company are good. People are desirous to have gas put into their houses, and, though the progress of the company will not be rapid, I think it will be steady.

Mr. STOKES: I would suggest that with persons holding positions like this, a security is usually given. You are aware that there are offices which guarantee fidelity.

The CHAIRMAN: We have made the present manager enter into a guarantee for a considerable sum. At the same time I fear we must not rely too much upon it. I should very much doubt whether, under the circumstances, we should have gained the guarantee in the case of the late manager, supposing there had been one.

Mr. STOKES: Is there any one over there to look after the new manager?

The CHAIRMAN: We have local directors and a local secretary there. The position in the colony of the local secretary, Mr. Conyers, is an important one.

The motion for the adoption of the report was put and carried.

The proceedings closed with a vote of thanks to the chairman and directors.

PURCHASE OF THE WARRINGTON GAS-WORKS BY THE CORPORATION.

REPORT BY MR. R. P. SPICE AS TO VALUE OF UNDERTAKING.

To the Mayor and Corporation of Warrington.

Gentlemen.—Honoured by your instructions to advise you as to the terms upon which you have agreed to take over the works and entire undertaking of the Warrington Gas Company, I felt and decided at once that until I had examined the works and accounts of the company, that I might then be in a position to form a reliable opinion of the present state of the concern, and looked back into its past history, I ought to keep my mind entirely free from any possible bias which might be engendered by making myself acquainted with the terms of purchase; and with this object in view I abstained from reading the printed statement which had been forwarded to me, and did not look at it, nor at any other document relating to the details, or even the substance of the agreement, until I had examined the works and accounts of the company, and formed an opinion of my own as to the fair value of the undertaking as a going concern.

I make this statement now from a conviction that it is due to you as a public body representing the ratepayers of your borough, and being, in fact, the trustees and guardians of their interests, that you should have the satisfaction of knowing that, let my judgment be worth much or little upon such a matter, it has, at all events, the merit of being *unbiassed;* and that the mere fact of its being known to me, as to any other casual reader of public news, that you had agreed to buy the gas-works, has had no influence upon me whatever; as you may suppose, when you are reminded that with my time fully occupied, any such item of news in which I am not personally concerned, would, so to speak, go in at one ear and out at the other. Hence it happened in your case that my mind was blank as to the merits or demerits of the bargain.

I may now inform you that on the earliest day after receiving your invitation, I visited Warrington, and reported myself at once to his Worship the Mayor, and afterwards called at the works and made an appointment with Mr. Paterson for the next morning for my official inspection and examination.

On the following day I attended accordingly at the works, and was at once conducted over them by Mr. Paterson, who furnished me, without any reserve, with minute particulars concerning all that was underground, and consequently beyond my view; and in general terms I may inform you, that the arrangement of the works and their structure are such as to command the good opinion of any engineer whose capacity for forming one has been enlarged and improved by having visited professionally the greater number of the more important gas-works of the United Kingdom.

Here I must beg that I may not be misunderstood, and that it may not be thought that I am dealing in flattery, from a kindly feeling to one standing so well in the estimation of his professional brethren as Mr. Paterson does. I say distinctly that I am fully sensible of the responsibility I have assumed in accepting the office of judge between you and the gas company and their engineer, and that what I now place upon record may perchance be subjected to the criticism of another acknowledged authority. Hence I am by no means inclined to treat the matter lightly or inconsiderately; but in all seriousness I say that, in their general design and structure, they will not suffer by comparison with any modern well-constructed gas-works.

For the most part the buildings are new, and the apparatus also, and the only department in which any deficiency of power exists is that of the purifying. The condensing power is in excess of present requirements; but, owing to a combination of unfavourable circumstances, the erection of more powerful purifiers, in addition to those now doing the work of the establishment, has been deferred. They are, however, in hand, and in a short time will be erected, and what is very satisfactory in regard to them, the company have the money now lying in their bankers hands, ready to pay for them; so that, before the works will be, or can be, handed over to you, they will be perfected in this particular, and complete in all respects, and amply sufficient to produce and supply gas to meet all present demands.

I may also observe that a very important revision of the mains in the principal streets has been made within a recent period, the company having consulted the public convenience by taking the opportunity, when the streets were being repaved, to take up their old and small mains, and lay in lieu of them new mains of a larger diameter, thus providing for a considerable increase of business, and at the same time securing greater economy by reducing the leakage.

So far, then, as relates to the works; and now for the commercial part of the matter.

I find that by the time the undertaking becomes the property of the corporation, there will be, at present prices of gas and materials, an annual profit of not less than £7000, and having due regard to all the circumstances—viz., the character and state of the works, their being practically new, or nearly so, very substantial in every department, whether as to buildings or plant, and more than equal to present requirements, the company having a large reserve-fund and floating capital to hand over with the undertaking, besides a valu-

able stock of stores, implements, fittings, &c.—the value cannot be set at less than 25 years purchase, which means £175,000, and this, if borrowed at 4 per cent., would entail an annual payment of £7000, and if the bargain had been concluded on this footing it would not have been a bad one for the corporation, for this reason—that Warrington is a notoriously thriving place, and in every such town or city the demand for gas is constantly growing, and the normal rate of such increase is 10 per cent.; it has even been found that in some instances where there has been no increase in the population, and the trade of the locality has not been prosperous, yet the consumption of gas has grown year by year, the secret being that gas is the cheapest of all artificial light, when sold at moderate rates; and the circumstances ensuring an increasing demand for gas at Warrington, the corporation, if paying the full value for the concern, would have the advantage of coming into the possession of a business, increasing in value year by year, at such a rate as would leave the question to be decided as to whether the price of gas should be reduced below its present low rate, or maintained at the same price till a large reduction of the imported capital be paid off out of surplus profits.

But such is not the state of things to-day; the bargain I find to be in round numbers this:—

The corporation are to have handed over to them a business carried on now at an annual profit of	£7000
For which they are to pay annually	6120
Leaving a balance in their favour of	£880
Besides which will accrue a saving of £500 a year now paid to directors	500
Leaving a total net profit of	£1380

And thus the result of the first year's working will be a net gain of £1400.

I have not mentioned the two sums of £900 and £1800, equal to £2700, to be paid as so-called bonuses, because they will be paid out of moneys now belonging to the concern, and will not in reality affect the question.

The only conclusion that I can come to is, that the transfer of the works to the corporation, upon the terms agreed to, will be a great and lasting benefit to the ratepayers of Warrington; and I am quite satisfied that the results of the future will abundantly confirm my present opinion.

(Signed) R. P. SPICE.

21, *Parliament Street, Westminster, S.W., Nov.* 16, 1876.

BOMBAY GAS COMPANY, LIMITED.

The Half-Yearly Meeting of Shareholders was held at the Offices of the Company, Great Winchester Street Buildings, London, on Thursday, the 23rd inst.—D. T. EVANS, Esq., in the chair.

The SECRETARY (Mr. Marshall) read the notice convening the meeting, and the following report and statements of the company were presented:—

Your directors have pleasure in submitting to the shareholders a statement of accounts, duly audited, for the half year ending the 30th of June last.

The condition of the company is satisfactory.

The new contract with the municipality of Bombay for the public lighting of the city was completed, and took effect on the 1st of July last; when the reduction in the price of gas to private consumers also came into operation, and it is anticipated that both will work for the mutual advantage of the company and the community of Bombay.

Exchange has continued throughout the six months unprecedentedly low. The remittances have been unusually large; consequently the loss has been severe, amounting to £5537. Your directors, after much consideration, have deemed it advisable to charge profit and loss account with £1500, as against £600 this time last year, to debit exchange equalization account with £1462, and to write off from the reserve-fund £2575, leaving £1000 to debit of exchange account, to be dealt with at the close of current half year, during which there will be no remittances required from India.

The rates for freight, and the price of coal, offering favourable opportunities for increasing the stock of coal, your directors have now afloat and ordered several thousand tons, at extremely low prices, and the result must be beneficial hereafter.

The net profit for the half year is £11,752 12s. 1d. To the reserve-fund, the sum of £3000 has been added, and from it £2873 4s. 4d. has been written off for depreciation and loss on exchange (thus raising it to £8031 12s. 5d.). Your directors, out of the balance disposable, have declared an interim dividend of 3½ per cent. for the half year, free of income-tax, leaving £379 15s. 6d. to be carried to the credit of the current half year.

The dividend will be payable on and after the 1st day of December next.

GENERAL BALANCE, *June* 30, 1876.

Dr.				*Cr.*			
To Capital authorized— (50,000 shares, at £5 each—£250,000.)				By Construction account			
40,000 shares, £5 paid			£200,000 0 0	Added this half year			6,521 10 4
10,000 „ £4 paid			40,000 0 0				£203,406 2 9
Debentures			14,850 0 0	Less written off preliminary expenses account			200 0 0
Amount owing by the company			1,871 18 5				£203,206 2 9
Reserve-fund		£7,904 16 9		Retort account			1,013 18 10
Added this half year		3,000 0 0		Exchange equalization account			1,000 0 0
		£10,904 16 9		Stock in trade, viz.—			
Written off for depreciation and preliminary expenses	£297 13 8			Chandeliers, Brackets, &c.			5,559 1 8
Written off for loss on exchange	2,575 10 8			Brass and iron goods, tubing, &c.			5,410 6 9
		2,873 4 4	8,031 12 5	Materials, mains, and services			1,834 8 7
Insurance-fund			1,332 1 3	Meters			2,447 14 6
Passage-fund			383 17 11	Coal			24,205 0 0
Balance to general revenue account			8,779 15 6	Coke			207 18 0
				Tar			50 7 8
				Tools and sundries			688 10 5
				Amount owing to the company			6,739 8 0
				Cash at bankers, on deposit, and in hand			22,886 8 4
			£275,249 5 6				£275,249 5 6

PROFIT AND LOSS ACCOUNT, *for the Half Year ending June* 30, 1876.

			By			
To Coal carbonized	£7,497 12 2		Gas and meter rental	£19,882 16 1		
Wages	1,093 14 0		Coke, tar, fittings, &c.	5,951 13 11		
Purifying	12 0 0		Transfer fees, &c.	13 0 0		
Maintenance of retorts	202 16 0					
Trade and general charges	819 14 5					
Salaries and collectors commission	1,891 15 7					
Rents, rates, and taxes	183 1 5					
Directors and auditors remuneration	676 5 0					
Bad debts	23 12 9					
Law expenses	1 3 10					
Exchange account	1,500 0 0					
Passage „	50 0 0					
Interest „	143 2 9					
Net profit	11,752 12 1					
	£25,847 10 0			£25,847 10 0		

GENERAL REVENUE ACCOUNT, *June* 30, 1876.

To Dividend for half year ending Dec. 31, 1875	£9,600 0 0		By Balance, Dec. 31, 1875	£10,072 13 5		
Interest on debentures	445 10 0		Net profit for half year ending June 30, 1876	11,752 12 1		
Amount carried to reserve-fund	3,000 0 0					
Balance carried down	8,779 15 6					
	£21,825 5 6			£21,825 5 6		
			1876, July 1.—By Balance brought down			£8,779 15 6

The CHAIRMAN: Gentlemen, I need not detain you on the present occasion with many remarks, because the report and balance-sheet circulated among you enters so fully into details, and are in every respect so copious, that they leave me little to say. Nevertheless, I may be able to touch upon one or two points that affect the company, and which you may be interested to hear. The gross revenue for the last six months, as compared with the corresponding half year of 1875, shows an increase of £1389; and the gross expenditure a decrease of about £173 (if you put out of view £900, which is the increase in the sum charged on loss by exchange), so that these two items show a net increase of profit of £662, which would, of course, have been larger, but for the loss just alluded to. With reference to finance, we consider the company to be in a sound and satisfactory condition. The cash at bankers, on deposit, and in hand, amounts to £23,000. That seems a very large sum, but out of it we have to pay £3100 for debentures on the 1st of January next. You will remember that we originally borrowed about £20,000—the exact sum was £19,750, and by the payment in January next we shall reduce our debenture debt to £11,650, and the charge for interest from £1185 to £699. In two years time the whole of our debentures will fall due, and we hope to wipe them all off without renewal. I come now to the most important matter for consideration that will require some remarks from me—I mean the question of the Loss on exchange. You are, of course, aware that the depreciation in the value of silver, and various other causes, have made that loss a very serious one. I am standing before you now to account for a loss of £5537 on the remittances from India during the six months under review. I am happy, however, to assure you that as there will be no remittances there will be no loss on exchange during the current six months. I hope you will endorse the policy of the directors in "taking the bull by the horns," and wiping off the very large amount we have lost in the past half year in the way stated in the report. I need not go further into the matter, because you already have it before you; I will only say that, enormous as our loss appears to be, it is small in comparison when we consider the rates which have prevailed. The lowest rate for six months bank bills in the past six months was 1s. 6¼d. per rupee; the highest was 1s. 8¾d. The lowest rate of our remittances was 1s. 8¾d., so that you see our loss might have been greater than it is. On the total remittances of £38,000 our Loss on exchange represents 14½ per cent.; which, in point of fact, would give about 2½ per cent. upon our dividends. Well, gentlemen, as I said last time, it is "a long lane that has no turning," and I may now say that I hope we have seen the worst in this matter of exchange. The value of the rupee is steadily but slowly rising. It is now 1s. 9¼d. for six months bank bills; the price of silver is gradually advancing, so that we are not without some ground for expecting that there may be at no distant time an end to this dreadful depreciation. Now, it will be satisfactory to you to know that we have something to set off against this loss. Freights and coal have been unusually low, and we have shipped very large quantities of coal at the lowest rates we have ever been able to put them into the works at Bombay. We estimate that we have at present 9000 tons of coal in stock, and that we have, chartered and afloat, 9000 tons more—altogether about two years supply—so that, as they say in the City, "we shall sit on velvet" for that period. I come now to touch upon the new contract with the Municipality. It will be satisfactory to you to hear that, although the required extension of mains was very large—no less than 15 miles—and the number of new lamps 750, the whole of this work has been carried out effectively, and within the time specified in the conditions of the contract. I may add that they have given satisfaction in Bombay, both to the Municipality and to the General public. It is, of course, a very important consideration how that contract will work. As yet, the time is too short to allow us to speak with any confidence upon the point, but we hope and believe it will prove satisfactory to every one concerned. I should tell you that our works and plant are in good condition. We are just going to renew the sides of our purifiers, and with that exception all the apparatus is what we desire it should be. Looking also to the prospects of the half year, we have reason for encouragement. Our manager writes, in his last communication, "All my coke was sold when I left the works this morning, and carts were waiting for the eleven o'clock draw," and he adds that "it is taken off at fairly remunerative prices. He further informs us that he has a good deal of fitting work in hand, and when the new docks are finished great things are expected, and no doubt the city will improve in trade and importance." I think, gentlemen, I have now touched upon most of the questions of interest to you, and I beg to move—"That the report of the directors and the balance-sheet be received and adopted."

Major SUART seconded the motion.

A SHAREHOLDER inquired whether any interest was allowed to the company for money on deposit, and if so, where it appeared in the accounts.

The CHAIRMAN reminded the honourable proprietor that at present money was worth very little, and the company were bound to utilize it to the greatest

extent. The interest received for cash on deposit appeared in the profit and loss account under the general head of interest.

The SHAREHOLDER expressed an opinion that the stock of coal was unnecessarily large.

The CHAIRMAN said, with regard to coal, he meant to have drawn attention to the fact that under their new contract the company were carbonizing some hundreds of tons of coals more per annum. When the price of coal was favourable, and freights low, it was the duty and interest of the board to take advantage of the circumstances, and to put coals into the works as largely as possible. Even now the price of coal was rising in Bombay.

A SHAREHOLDER wishes to draw attention to the gas and meter rental, which appeared to him to be diminishing, and to be about £900 less than in the previous half year. The salaries and commissions also appeared to be greater.

Mr. H. P. STEPHENSON said the comparison should be made, not with the previous half year, but with the corresponding half of last year. If that were done it would be found that the gas and meter rental was £30 more. As to the salaries commissions, &c., they were exactly the same in amount as for the first half year of 1875.

Mr. STOKES thought the directors had exercised a wise discretion in purchasing large quantities of coal. When the coal famine set in a few years ago, the prudence of the board had provided against it by extensive previous purchases, which not only served the manufacturing purposes of the company, but enabled them to dispose of a large quantity at considerable advantage. Referring to a point he had often before mentioned, he inquired what had been done with the large stock of chandeliers, brackets, &c. The loss on exchange had been a serious one to the company, and he would suggest whether, to prevent a recurrence of such loss, some plan could not be devised for purchasing products in India for export to England instead of remitting cash.

A SHAREHOLDER said he observed, on an examination of the accounts for June, 1875, that the loss on exchange on a net return of £11,090 was only about £600. For the corresponding six months of this year the loss amounted to no less than £1500, notwithstanding the additional sum realized was only £750 more.

The CHAIRMAN replied that on the former occasion they brought over much less than now, and the rate was higher.

Mr. H. P. STEPHENSON said the honourable proprietor was looking simply to the item of net profit. The total loss was £5000, of which the directors had charged to profit and loss £1500, to the reserve-fund £2575, and the exchange equalization account £1000, which they intended to write off during the current half year, as they would be receiving no remittances during that period. In the corresponding period of 1875 the loss of £600 on exchange, charged in the profit and loss account, was not the whole amount lost, as a considerable sum was charged to the equalization account. The directors generally drew their money at one time of the year, placing it on deposit during the blank time in Bombay. In March or April of next year, when they expected the exchange would be at its best, they would be getting their remittances.

A SHAREHOLDER said he thought the amount owing to the company was too large, and suggested whether by offering discounts for prompt payment the directors could not collect more closely.

Major SUART said the amount due from consumers was not equal to a three months rental.

The CHAIRMAN added that the custom in Bombay was to pay monthly, and he thought a comparison of the accounts of this company with those of others would show a very favourable state of collection.

Mr. H. P. STEPHENSON said before the recent reduction in the price of gas they did offer a discount for prompt payment. Since the price of gas had been brought down to 12s. the discount had been abolished, but the company charged a small interest on accounts not paid after one month.

The CHAIRMAN, replying to further inquiries, said the company were using both English and Australian coal. The Municipality made their payments with the utmost regularity. With reference to money on deposit, the directors sometimes had considerable sums in Bombay waiting until the rates of exchange were most favourable for sending home. They made the best arrangements in their power, but, as a rule, they only got from 2 to 4 per cent. interest on deposits. In answer to Mr. Stokes's question, he was happy to state that the stock of fittings, &c., was so much reduced that the directors were now sending out 12 and 15 light chandeliers; the remaining stock has been written down to the cost price. As to the suggestion made by Mr. Stokes in reference to a mode of reducing the loss by exchange, he could only say they could not become a trading company; and any enterprise undertaken in the way Mr. Stokes had suggested would have to be done by the directors at their own risk, and any shareholder could attack them for it.

A SHAREHOLDER: Could not the freightage and payment for coal be made in Bombay?

The CHAIRMAN: We do it as far as we can. The coals we send out from here, and the freight are payable one-half in this country and one-half at Bombay.

The motion for the adoption of the report was then put and carried.

This was the whole of the business of the meeting.

Votes of thanks to the chairman, directors, and auditors closed the proceedings.

ACCOUNTS OF THE SALFORD GAS COMMITTEE.

The following is the report of the Gas Committee of the Salford Corporation, for the year ending June 30, 1876:—

"The quantity of gas made this year is 583,470,000 cubic feet, as against 533,406,000 last year; 501,805,838 cubic feet had been sold and used, as against 461,332,705 last year. The increase in the amount made was 50,064,000 cubic feet, and in the amount sold and used 40,473,133 cubic feet.

"The average illuminating power of the gas, as tested by Dr. Angus Smith, had been equal to 20·17 sperm candles.

"The rental from private consumers within the borough was £73,295 10s. 7d., outside the borough, £20,644 12s. 7d.—total, £93,940 3s. 2d. For meter-rents, the figures were £1857 1s.; £328 12s. 6d.—total, £2185 13s. 6d. Public lamps, £6262 19s. 7d.; £1166 4s.—total, £7429 3s. 7d.

"The total rental in the borough was £81,415 12s. 2d.; outside, £22,139 8s. 1d.; grand total, £103,555s. 0s. 3d., being an increase over last year of £8648 4s. 10d. There has been an increase of 908 hired meters, the number now in use being 14,149; of 233 consumers own meters, the numbers being 9069. The number of public lamps is 4658, against 4334 last year. The total number of consumers and public lamps is 28,202, being an increase of 1792 on last year; 1965 new service-pipes had been laid to private consumers as against 1982 last year, and there had been 324 new and additional lamp services, as against 303 last year.

"During the past year your committee have laid 22,810 yards of new mains; 8499 yards of which replaced others of less dimensions.

"The gross profit of the past year is £22,218 10s. 11d., compared with £18,581 1s. 1d. in the preceding year, and it is appropriated as follows, in accordance with the provisions of the Salford Improvement Act, 1862, section 413, namely:—For interest on the mortgage debt, £12,111 17s. 7d.; towards the sinking-fund, £6545 16s. 6d.; and for the annuity to the Salford district, £2530, leaving a balance of £1030 16s. 10d.; available for depreciation-fund accounts.

"Your committee are making a thorough investigation into the condition and capacity of the works, and will shortly propose considerable alterations and extensions of the same.

"Although the returns for the past year do not show any surplus profit, your committee, after a thorough examination, have placed the stock account, and, in fact, the whole department, on a more satisfactory basis, and with the new management they are fully satisfied that they have entered on a prosperous future."

Tables are appended showing that in Salford 5871 yards of mains have been laid during the year ending June 30, 1876, of which 1828 yards consist of larger mains laid in substitution; 5132 in Pendleton, and 3668 in Broughton, and 8139 outside the borough, making a total of 22,810 yards; 1828 yards have been taken up in Salford, 3428 in Pendleton, 1248 in Broughton, and 1995 outside the borough, making a total of 8499 yards.

AMERICAN GASLIGHT ASSOCIATION.

(*Continued from page* 741.)

The first paper read was on

SOME PRACTICES IN GAS ENGINEERING AND MANUFACTURE CONSIDERED.

By Mr. E. S. CATHELS, Gas-Works, Montreal.

Having been requested by the respected secretary of this Association to prepare a paper for this meeting, I undertook to endeavour to comply; but as the time approached, and I began turning over in my mind several subjects in connexion with our profession, without finding that I had anything worth saying, if I restricted myself to any one of them, I was, in despair, forced into the alternative of taking up several instead, and of offering such remarks on each as suggested themselves. To keep the paper within reasonable length the important question of distribution has been excluded, other than what arises out of the consideration of the first of the following sections. Such a medley may not be so acceptable as a paper more thoroughly treating some single topic, but it has the advantage of presenting a wider range of differences of opinion and discussion, and in that sense may be the medium of interest and instruction.

Sites for Gas-Works.

The first subject in order that presents itself is that of the selection of sites for gas-works to be constructed. It seems to be a generally accepted principle that the lowest level in a district supplied with gas is the most advantageous for distribution, there being an equal delivery obtained with less initial pressure than from a higher level, and consequently, as it is believed, less leakage over the district. Now I think this presumed advantage is overrated. I do not believe the lowest site is necessarily the best in this respect, my objection, indeed, being based on the very grounds commonly urged in its favour.

Owing to the less cost by water, than land, carriage of coals and other materials required, and in the removal, especially, of the liquid residual products, it is perhaps, generally speaking, desirable that gas-works should be situated on the banks of navigable rivers or canals, and as the former are always, and the latter usually, in the lowest levels, such situations may be the most suitable in that respect; (but, for reasons to be hereafter adduced), this more particularly applies to climates where navigation is open all the year round. Old gas companies in such temperate climates frequently have their works so situated as to ensure water carriage, but it should be borne in mind that when they were established, there was, as a rule, no choice between such and cartage, railway communication being either non-existent, or available to but a limited extent.

Another likely reason for the preference, in the early days of gas lighting, of low-level sites, consisted in the fact that the highly important advantages of exhausters were then lacking, and to reduce the pressure in the retorts the gasholders were lightened by counter-balancing, only weight enough being left in them to give the maximum distributing pressure. Of course the lower the level of the gasholders in respect to the district to be supplied, the less initial pressure was required, and the further could the advantage of lightening the holders be pushed. But these conditions no longer exist, and we ought not to shut our eyes to this fact, and go on reasoning and acting as if they did.

Assuming an average, taking one place with another and summer with winter, of say six hours heavy consumption out of the 24 hours, during which time high pressures are necessary in the mains, there are 18 hours, or thrice that length of time, when only a minimum pressure is required or desirable. It is almost needless to say that the leakage of the few hours of high pressures, when there is a correspondingly heavy draught on the mains, is comparatively unimportant to that of the rest of the 24 hours, when there is but little consumption, and during which time it is impossible, in districts where the altitudes vary to any considerable extent, to keep the pressures in the higher areas down to a proper limit, without resorting to special means, such as distinct systems of mains supplied at different pressures, gasholders situated in the higher levels, or the employment of district governors; and the lower the level of the works, the more is this evil aggravated.

It would thus appear that there are two sides to this much-bepraised and believed-in low-level site theory, as regards distribution, and in that respect, instead of being an advantage, it is in many cases a positive and serious disadvantage and source of waste. Without going the length of affirming that gas-works may be above the level of the bulk of the consumption, of what consequence is it—always assuming the outlet-mains to be of sufficient calibre—for the sake of a little extra initial pressure during five or six hours of the 24, whether the works be situated, 10, or 20, or even 50 feet higher? Even at 50 feet only, about 5-10ths additional initial pressure would be required—say, from 15 to 20-10ths—the objection to which seems like riding a hobby unnecessarily hard.

But there is another aspect of this question of the site of works, deserving of notice, and which particularly applies to the northern portions of this continent in which there are gas-works, and to works so situated as to have only water transit available—viz., the more or less serious depreciation in the quality of the coals, which are, in such cases, necessarily stored in bulk for six or seven months consumption, when navigation is closed, through the insensible but certain evaporation of gas from the heap, a loss that materially affects both the quantity and quality of the production, when the coal comes to be used, and which, with the other expenses incurred in stocking, becomes a very important factor in the cost of manufacture.

Mr. Graham, then of the Stalybridge Gas-Works, in a series of exceedingly elaborate and exhaustive papers, "On the Valuation of Gas Coals and Cannels," contributed to the English JOURNAL OF GAS LIGHTING in 1874, since published by the author in book form, treating on this subject of loss by stocking, estimates the loss on coals costing 20s. per ton laid down, when the decrease in the production and illuminating power are each but 5 per cent., at 2s. 8d. per ton. As he conclusively shows that the aggregate of the several losses incurred when coal has to be stocked, is a matter of high importance, I will, at the risk of being thought tedious, here take the liberty of reproducing a few extracts bearing thereon.

"A shed capable of holding a stock of, say, 1000 tons, will, with the ground on which it stands, probably not cost less than £1000, interest on which amount, at 7½ per cent., would be £75, which, divided by 1000, would show that each ton of coal stocked was costing 1s. 6d. more for interest alone than the same coal laid down before the retorts for immediate use; but the wages for stocking had also to be paid at, say, 9d. per ton, and if a railway were used this 9d. would represent the value of a charge of 7½ per cent. on its probable cost, and the labour entailed in working it; for in the case of stores other than that in, or very near, the retort-house, the railway would not materially affect or cheapen the value of stocking, inasmuch as a railway for a store-shed would not be used throughout all the year, but only during the short period of time the stores were being filled; and further, it would cost 6d. to bring each ton of coal from this store-shed to the front of the retorts; so that these several items would together form a charge as below:—

	Per Ton.
Interest for use of store	1s. 6d.
Interest for use of railway, or to pay for manual labour to store coal	0 9
Cost of removal from stores	0 6
Together forming a charge on the coal stored of . . .	2 9

"But if coal is stored it is usually paid for when stocked; and if stocked, to be used six months afterwards, the interest for the use of the value of the coal, for half a year, at, say, 5 per cent. per annum, has also been lost, equal to 1-40th of 20s., or 6d. per ton, which, together with the previous charge of 2s. 9d., will collectively make a cost of 3s. 3d. per ton.

"The values of the proportional fall of illuminating power, and of production per ton, are tabulated below, showing the per centage of fall—a coal producing 10,000 cubic feet of 14-candle gas, at 20s. laid down, and a cannel producing 10,000 feet of 22-candle gas at 30s. per ton, being taken as the assumed standards of quality. Coal originally producing 10,000 cubic feet of 14-candle gas, and worth 20s. delivered. Cannel originally producing 10,000 cubic feet of 22-candle gas, and worth 30s. delivered.

Per Centage of Loss.	Illuminating Power in Candles.	Return per Ton.	Decrease of Values corresponding to Decrease of Makes and Illuminating Power.*	Value of Interest and Cost of Stocking at 3s. 6d. per Ton.	Both Values Added.	These Values *plus* the Original Cost of the Coal.
Loss.	Candles.	Feet.	Less than 20s. s. d.	s. d.	s. d.	s. s. d.
0 per ct.	14·0	10,000	..	..	..	+ 20 = 20 0
5 ,,	13·3	9,500	2 8	3 3	5 11	+ 20 = 25 11
10 ,,	12·6	9,000	5 3	3 3	8 6	+ 20 = 28 6
15 ,,	11·9	8,500	7 8½	3 3	10 11½	+ 20 = 30 11½
20 ,,	11·2	8,000	10 1½	3 3	13 4½	+ 20 = 33 4½

* The items in this column are arrived at by calculations in preceding tables in the papers from which the extracts are taken.—E. S. C.

"From this table it appears that if a coal were purchased at 20s. per ton delivered before the retorts, which, when laid down, was capable of producing 10,000 cubic feet of 14-candle gas, and if, instead of using this coal, it were stocked to be used say six months hence; if it were then found that it had lost 5 per cent. of its illuminating and productive power, it would be worth 2s. 8d. less than its original value, 20s.; but as this loss of value had to be restored by the purchase of extra quantities of cannel, it would practically have cost after this depreciation of quality was restored 5s. 11d. more than the fresh coal at 20s., and it would now have cost 25s. 11d.

"If 10 per cent. were lost it would be worth 5s. 3d. less than 20s., but would have cost 8s. 6d. more, or it had now cost 28s. 6d. as against 20s. And so on up to losses of 15 per cent. and 20 per cent., the prices per ton being raised to 30s. 11½d. and 33s. 4½d. respectively, instead of 20s., the original cost."

Mr. Graham's figures, although perhaps not universally applicable as to the precise values given, and making allowance for the less depreciation of coals of a hard and compact structure, than softer and more friable kinds, yet indicate what doubtless, in many cases, is a very serious aggregate loss, where coals have to be stored for winter use.

It may be asked what has this to do with the question of high or low level sites? The answer is, that as respects this country—and it is with America we are interested—it may have a great deal to do. Low-level sites, *par excellence*, are contiguous to rivers ice-bound for half the year, and if the only means of transit in connexion with the works is by water, the winter consumption of coals must be stored with the injurious results, in a greater or less degree, so strikingly set forth in the foregoing quotations, to say nothing of the removal of residuals.

In concluding this section, I desire to express my dissent from the prevalent belief in the advantages of low-level sites, in respect to economy of distribution. In the distribution from works situated on about a level with the bulk of consumption, there is, for the few hours of general lighting, a higher pressure in the districts near the source of supply than is necessary, with a fair and adequate supply beyond, taking it for granted that the mains are of sufficient calibre and judiciously arranged; and with a practically perfect control over the pressures during the whole time of minimum consumption. The evil effects to the consumers in the area of excess of pressure are easily and cheaply obviated by the use of a dry governor attached to the meter.

On the other hand, when works are situated to any considerable extent, below the level of the major part of the consumption, a little less initial pressure suffices for the supply in the evening, but with the detrimental effects to the company of an excess over the higher portions of the district continuously. It is true that valves may be inserted in the mains to diminish the difficulty, but their efficacy is restricted to the few hours of heavy consumption, outside of which time they are of no avail whatever. Apart from the expensive alternatives previously alluded to, of separate systems of mains, or outlying gasholders, the use of dry governors in the mains is the only available remedy at moderate cost, and they are extensively employed in England.

It thus seems to me that in respect of distribution, these much-vaunted low-level sites, are a decided mistake; also, that in the parts of this Continent in which there is a cessation of navigation in winter, the selection of a site for works on a railway, by which fresh-mined coal could be obtained all the year round, although at considerably higher rates of carriage than by water during summer, is, all things considered, preferable to a site having water communication only.

Retort-Houses and Retort-Settings.

The retort-house, and the operations carried on within its walls, undoubtedly stand first in importance in a gas company's business. It is there the prime article of their manufacture—the gas—is produced, and on these operations mainly depend both the quantity and quality of its productions, and also the quantity, relieved for sale, of the product from which the next largest revenue to that of the gas is derived—viz., the coke.

As respects the house itself, but little requires to be said. A good width in front of the retort-benches is desirable, especially where the coal is carted into the house. It makes the house cooler and more comfortable for the men, but like all other gains it has its price, in the greater loss of heat, by radiation from the benches, requiring to be made up by the consumption of extra fuel.

In the matter of ventilation it is hardly necessary to mention that openings in the walls, on a level with the benches, should be avoided, and that the cold external air, continuously pouring into the house, should not only be above the line of retorts, but should be controlled in quantity according to the temperature. The exceedingly chilling effect experienced by a person while standing, for a few moments only, in the strong indraught through a doorway opening, even when the temperature is but moderately low, enables one to form some idea of the very considerable abstraction of heat from the retort-benches, in the case of such currents being continuous. This objection is referable, of course, more particularly to winter, and is presumedly wholly inapplicable to the "Sunny South," where thorough ventilation may be expected to be a necessity, to enable the stokers to perform their exhausting labour in hot weather.

Touching the question of a single high chimney-stack for each house; two or more shorter ones projecting above the roof ridge, say, 15 to 20 feet; shorter ones still, either of brick or sheet iron, delivering the used furnace gases inside the roof, and each serving for one or more settings; and no chimneys at all, as I understand to be the prevailing custom in this country—I desire to speak, with some diffidence, my experience having been confined to the two first-named classes, although I prefer chimneys. In cases in which coal is used as retort fuel, it seems to me that high chimneys are indispensable to create such a draught as will ensure a sufficient quantity of air being drawn through the furnace to burn each of the bodies into which the coal is resolved—viz., the coke, the hydrogen, and the carbon of the gas into carbonic acid, in the furnace instead of at the chimney top, and for like reason a greater furnace-bar area than where coke is used is necessary. But in the general practice of using coke as fuel, the question of chimneys or no chimneys appears to be of less moment, so long as there is sufficient draught for proper combustion.

In England, so far as I am aware, the use of chimneys for retort-houses is universal. But instead of one high chimney for each house, two or more comparatively short ones (depending upon the length of the house), viz.—one above each barrow-way passage, from one side of the house to the other, and which cut the bench or range of arches into sections of six or eight each, is now being pretty generally adopted. Two sides of each chimney rest on the adjoining buttresses, at the end of the respective sections, on each side of the passage, and the other two sides are supported by an arch over the passage, sprung off these buttresses. This system acts exceedingly well, the main flues leading to the several chimneys taking each the spare heat from three to six beds on each side of the chimney as the case may be. These chimneys, although usually built wholly of fire-brick, are but inexpensive, and are conveniently out of the way.

As an example of the working capacity of such chimneys, I may state that I have found one with a 4 feet by 4 feet flue, and 50 feet high from the top of the retort-bench, give sufficient draught for 18 fires, each heating a bed of seven 10 feet long retorts, being eight-ninths of a square foot of flue area per furnace.

For another house in the same works there was a circular chimney 70 feet high from the level of the main flue, and having a 4 feet diameter flue, being slightly more than 12½ square feet in area, which took six through beds on each side of it, or 24 fires, each heating seven retorts, being, say, half a square foot of area per fire, and which gave amply sufficient draught.

I have already said that the desideratum is proper combustion, and believing this is more likely to be ensured by a chimney draught than without, I am bound to say, however unpopular such an opinion may be here, that I am on the whole in favour of chimneys.

I believe the objections to chimneys take something like these forms—that they are expensive, and are unsightly appendages to gas-works; that the fires nearest the chimneys have the most draught; and, what covers all the others, that they are entirely unnecessary, as is proved by the experience of the American gas world.

The replies to these objections are, that the cost of a chimney or chimneys in the constructive account of a gas-work, is such a mere bagatelle as to be undeserving of a moment's consideration, and that, at but comparatively trifling additional cost, they may, where thought necessary, be made so ornamental as to be the most conspicuously elegant features about the works; and that by a proper adjustment of the dampers, the beds nearest the chimneys need have no more draught than those farthest off. As to the major objection, of their being unnecessary, I would like to say a few words. It is true that American experience proves that retorts can be properly heated without chimneys, but the important question is, can they be heated as economically in the expenditure of fuel as where chimneys are used?

The heat evolved in combustion is increased in its vividness by the conversion of the whole of the carbon of the fuel into carbonic acid, and this completeness of combustion I believe to be more thoroughly attained by the greater draught of a chimney, of course care being taken, by adjustment of the draught, that cold air shall not be drawn through the setting. It is desirable to have a surplus of draught at command, which is secured for all time by the merely nominal first cost of a chimney or chimneys.

I am under the disadvantage of not having exact information as to the average, or ordinary retort fuel account of American gas-works, but from what I have heard, the consumption of fuel in heating the retorts is considerably in excess of similar works on the other side of the Atlantic. This I by no means attribute solely to the want of chimneys, because the arrangement of the retort-settings has so much to do with a greater or less consumption of fuel; but I think it is a fair presumption that the more efficient combustion by a chimney draught may partly account for the difference.

Coming now to the very important part of the procedure of the manufacture of illuminating gas—the retort-settings—I would desire to express my sense of the necessity of substantial foundations for the arches in which the retorts are set, both for the permanence of the structure, and the economy of fuel. The waste of heat in raising the temperature of under percolations of water may, through insufficient drainage, be a source of considerable continuous loss. It might be thought that the heat naturally ascending from the furnace would not be likely to permeate, to any appreciable depth, through the foundation or floor of the oven; but a single example would seem to indicate that, unless means be taken to obviate it, that it will do so to a greater extent than might be expected. Upwards of twenty years ago, when superintendent of gas-works built on the chalk formation in the south of England, I had occasion to overhaul a bench of arches which gave signs of settlement. On lifting the floor of the arches they were found to be resting on powdered lime 2 or 3 feet deep, showing that the heat had penetrated through the floor in sufficient intensity to burn the chalk into lime, a striking instance of the necessity of diverting possible sub-aqueous currents by drainage, and of the necessity of deep and solid foundations.

Respecting the number of retorts in the same arch, my experience has been that the consumption of fuel does not increase as the number of retorts. Settings of five are perhaps more generally used than any other number, but these I think might, in moderate-sized works, be advantageously superseded by a greater number. It is, I believe, contended by the advocates of these settings, that as there is a less absorption of heat in carbonizing coal in five than in six, seven, or more retorts of equal capacity, the size of the furnace and the other conditions may be so adjusted that the consumption of fuel need not be proportionately more, but practically that view does not hold good. A probable reason of the relatively heavier consumption of fuel is the proportionately greater area of front wall and arch covering, and, consequently, greater amount of lost heat; and the feasibility of this theory is brought home to one while standing for only a few minutes on the top of a bench of retorts in action, or even in front of the retorts, and reflecting on the enormous quantity of heat flowing continuously, day and night, from the bench. And the greater the exposed surface, in proportion to the number of retorts, the greater is the loss.

For this reason there is a considerable gain, instead of setting five retorts in two horizontal lines, the lower one consisting of three, and the upper one of two retorts, in arranging them two in width, instead of three—*i.e.*, in two tiers of two each, the fifth one being placed above, and vertically between the upper two. By this disposition an arch of about three-fourths the width required for the former arrangement suffices, not only correspondingly diminishing the radiating surface, but also having the additional advantages of economizing retort-house room; having the retorts in closer contact with the furnace heat, and presenting three vertical tiers instead of two, for the heat to rub against. For a similar reason, it is better to set a bed of three in a narrow arch, in vertical line, instead of in the form of a triangle, as they are usually set.

A practice that obtains, so far as I am aware, almost exclusively on this continent, in large works, is that of setting close-headed retorts, back to back, in a double-length arch—that is, with their back ends butting against a thick cross wall (in which are the vertical flues), which divides the oven into two equal

lengths. Now this system I am constrained, with all due deference, to disagree with. It diminishes the length and consequent working capacity of the retorts, as compared with double-length or through ones, by the thickness of the wall, and, what is of more serious consequence, presents a face at the end of each for the accumulation of carbon, rendering its removal so difficult, that special contrivances have to be resorted to to effect it.

I do not desire to be understood as asserting that there is any less accumulation of scurf on the sides of through, than there is in close-ended retorts, but there being no closed ends, the trouble is diminished to that extent, and this is found to be an important advantage. Leaving the lids slightly loose for a few hours, allowing an inflow air, causes such a shrinkage of the coating on the sides, as to permit of its detachment with the scurfing-bar in long flakes with comparative ease.

Even in the smallest works it is desirable to be able to open the back ends of the retorts. This is accomplished by having the bench say about 4 feet away from the retort-house wall, and having a short mouthpiece attached to the back end of each retort. The back of the retort is formed of a half-brick thick wall, the space between which and the mouthpiece lid being filled up. When the retort requires scurfing, this is cleared out and the back removed, when the carbon presents a flat face all round, of the thickness of the deposit, the current of air through the retort causing such a shrinkage as to enable it to be easily removed. Or if preferred it can be burnt off, by having a spare lid, both front and back, with a segment cut off each, and turning them round as required, causing the air to rub against the side of the retort in which the openings in the lids are. I have a strong belief that those adopting through retorts would find their advantages so decided, that they would not be likely to go back to close-ended ones.

Another aspect of this important question of retort arrangements is that of the quantity of brickwork in the setting. There are those who decry chequered supporting walls, and who affirm that they interfere with the free course of the furnace heat; that they absorb a portion of it; that they cause the retorts to crack; and I do not know what else besides. Some enthusiast, evidently of this school, not long ago set some retorts in Canada, eschewing the abominations of supporting walls; but the whole fabric tumbled to pieces in three months, as could only have been expected.

In a paper contributed to the last meeting of the British Association of Gas Managers by Mr. William Richards (the inventor of the two diaphragm dry meter, now almost exclusively made by dry meter manufacturers), on "The Theory of Retort-Settings," he advocated this anti-supporting wall theory, and advanced the objections I have enumerated. To the anticipated very pertinent question of "How, after the brickwork has been heated—has become saturated, so to speak, with caloric—can it absorb any more, and if it cannot, what becomes of it, always assuming a proper arrangement for its acting on the retorts, except by the retorts absorbing it, in the conversion of their contents from the solid to the gaseous state?" he could only reply that there are laws connected with caloric with which we are unacquainted, and ask in turn what becomes of the light of a lighted candle when placed under a bushel? the appropriate reply to which would be, that it would speedily "become" extinct. Well, one can only say, that the theory would seem to be as shaky as the settings, if such is the nature of its defence. That gentleman acknowledged that retorts, as ordinarily supplied in England, would not stand without the supports he condemned, but stated that, when engineer of gas-works abroad, he obtained from a Belgian maker, retorts that were so set, and lasted for years. The quality of a retort is doubtless of paramount importance, and it may be that the manufacturers are screwed down too much in price; that with a better price they could and would produce a better article; and I would say broadly, that if that could be done, it is mistaken economy on the part of gas companies not to obtain the very best that can be produced, for the sake of a little, or even a considerable, additional cost.

But general statements, such as the life of a retort, without giving its total production of gas, are often, if not misleading, at any rate very unsatisfactory. Retorts worked at a dull heat may last three or four years, and yet make no more gas than they would have done in, say, two-thirds of that time, if worked at a higher heat; while the cost of labour in handling coal making not more than two-thirds of what it was capable of producing, the waste of the coal itself in thus producing tar and oil instead of gas, and the additional consumption of fuel, would together be very serious.

Mr. Richards (whose views I here consider, because they are a fair exposition of the opinions of a class of professional brethren, in respect to these matters), exhibited the drawings, and explained the construction of a setting of six ovals, arranged in relation to each other, in the ordinary way of two vertical rows, one on each side of the furnace, each being a little from the side wall of the oven.

The bottom retorts rest each on a brickwork seating, and with a longitudinal flue, in the usual way, under it. The middle one on each side is supported by a close wall of blocks, reaching from front to back, resting on the bottom one, and the top ones are each supported by a similar close continuous wall or seating on the middle one. These walls or seatings, from being the only supports the retorts have, are necessarily of considerable width, the drawings showing them two-thirds the width of the retorts. A close ceiling of fire-tiles, extending from the front to within a foot of the back wall of the oven, rests on and covers the space between the two top retorts.

The furnace heat is thus enclosed in a chamber, the sides of which consist of the retorts and the close continuous walls between, and above by the close fire-tile ceiling. It has thus to pass along the enclosure or chamber to the back wall; up through the foot-wide space, between the termination of the ceiling and the back wall; forward to the front wall, outside such enclosure—*i. e.*, between the retorts and the arch—down, just inside the front wall, into the flue under each bottom retort, and back through these flues to the exit flue.

This may be called the horizontal system of heating retorts, in contradistinction to the vertical system, to be presently referred to, and I have been thus particular in describing it, because, with minor variations, it is a good general example of such system; in all the modifications of which the heat is caused to travel horizontally, first to the back, then to the front, and back again, under the bottom retorts.

To repeat here what I have said elsewhere, the furnace gases, like those produced in the retorts, will pass where there is least resistance, and in the case of settings of six, where there is necessarily a considerable width between those on the one and those on the other side of the oven, the heat flows therein in an unbroken-up mass, only its outsides being in contact with the sides of the retorts. In returning from the back to the front of the setting, the whole naturally keeps close up under the crown of the arch, while in the longitudinal flues under the bottoms, it is squeezed into too small a compass, such flues usually not being more than a third the width of the retorts.

That retorts so set can be sufficiently heated is true, but I think it is equally true that their heating requires an unnecessary consumption of fuel.

I may here mention, in passing, that I can see no necessity for the usual practice of setting the bottom retorts away from the side walls of the oven, wasting so much space, with its attendant evils. Even in settings heated on the horizontal system it is unnecessary. It may be asked how else is the heat to get into the flues under the bottom retorts? I reply, by cutting a flue way out of each side wall of the oven.

The system of heating retorts which I believe to be the best may be styled the vertical system, in which the furnace heat alternately flows up and down, through and among the retorts, having perfect freedom to pass between and surround them. The vertical system is divided into two modifications, called respectively two-chambered and three-chambered, which may, in a general way, be described as follows:—In both, the bottom retorts rest each on a longitudinal half brick thick wall, but which does not extend quite to either the front or back wall of the oven, and on corbels projecting at intervals from the side walls; each bottom retort being placed close to the side wall, the thickening at the mouth being let into the wall. In the former modification the oven is divided into two lengths or chambers, by a brick thick cross wall, built close round the retorts, but having suitable openings near and at its top. The furnace gases rise in the front chamber, or space between the front and division wall, striking against the retorts, and being thereby broken up, so that they spread and surround them, the middle retort being each a few inches from the side wall, to permit of its being completely enveloped. They then pass through the openings in the division wall, and descend similarly in the back chamber, or space between the division and back walls; thence forward under each of the bottom retorts, between the side of the furnace brickwork (arranged to merely catch under the side of the retort) and the longitudinal half brick supporting wall, round the front end of same; and back again through a similar flue, formed by the longitudinal wall, and the side wall of the oven, and up the leg of an A-shaped exit flue in the back wall, which joins into a single vertical flue; or into a cross flue at the back, under the bottom retorts, and up through a vertical exit flue, either in the back, or in one of the side walls of the oven. The under sides of the bottom retorts, it should be mentioned, are exposed to the heat, except the narrow strips, where they rest on the half brick wall.

In the other modification, instead of only one cross division wall there are two, which divide the length of the oven into three spaces or chambers, the one described in the foregoing arrangement, or two-chambered setting, being in this case nearer the front wall, and the other having no openings in it. The play of the furnace heat is the same as in the other, this additional wall forming the back wall of the second or descending chamber, and the heat in issuing from under the bottom retorts, instead of escaping by a vertical flue in the back or side wall, ascends among the retorts in the back or third chamber, and makes its exit through an opening in the crown of the arch.

The positions of the retorts are strengthened by arch ribs across the opening between those on one side of the oven and those on the other; by their being sprung off the sides of the retorts; and in beds of seven, disposed in the usual way of one being over the furnace, there is an arch the length of the furnace, with side nostrils to protect the retort. There are also in each chamber one or more chequered walls, as they are called, being merely half brick blockings between the retorts, which, with the arched ribs, are of the greatest value in preventing pieces dropping out of the retorts when they have been used long enough to crack. But in addition to these important purposes this internal brickwork has the further quality of acting as reservoirs, or magazines of heat, absorbing it when there is an excess, and restoring it when there is a deficiency; and, in my opinion, if they served no other useful end, would be well worth putting in for this latter advantage alone.

Just one word more before quitting this subject, respecting the materials employed in setting the retorts. There are those who use fancy moulded blocks instead of ordinary bricks for that purpose. These may or may not save a little in labour, but I am of opinion that even if there be any such saving it is more than counterbalanced by the extra cost of the blocks. With the exception of some half-dozen plain fire-tiles in a setting, I have never seen the need of using anything else but fire-bricks, and these seem to me to be the cheapest mode of setting.

Condensation.

It is now the opinion of the chemists that the pipes leading from the hydraulic main should convey both gas and liquids, and should be prolonged as much as possible, consistent with avoiding an over-reduction of temperature; and this view is confirmed by practical experience. Keeping the gas, as it leaves the hydraulic main, in contact as long as possible with tar and ammoniacal liquor is undoubtedly very effective in reducing the carbonic acid, the sulphur compounds, and naphthaline. A convenient way of effecting this is to support the pipe on the retort-house walls on brackets, leading it to and fro, with just sufficient inclination for the liquids to flow.

This alone is sufficient for winter condensation in this climate, but in summer the gas, on leaving this atmospheric condenser, should traverse a set of pipes passing backward and forward in a shallow tank of water, placed overhead, to enable all the water used on the works to be drawn from it. I find that, during the extreme heat of an American summer, it is almost impossible to sufficiently reduce the temperature of the gas by means of atmospheric condensers, even when water is trickled over them, and doubtless this accords with the experience of gentlemen present. There is a good deal in the saying that gas well condensed is half purified.

Washing and Scrubbing.

After leaving the condensers the gas, in my opinion, should go first through a washer and then through a scrubber, and in works of any considerable magnitude through two scrubbers. The arrangement I prefer and act on is that the washer be supplied from what has passed through the second scrubber; that the first scrubber be supplied with ammoniacal liquor, and the second one with either diluted liquor or water only, so as to absorb any ammonia that may remain in the gas; and that in each the supply be pumped up and passed through the scrubber again and again, until the requisite strength—say seven to eight degrees Twaddel, equal 14 to 16 ounce liquor—be obtained in the first. This, with the contents of the washer, is then run off for the sulphate of ammonia works. The arrangement is quite simple and manageable, while the cost of the little steam required in driving the pumps is practically *nil*.

I have the most favourable opinion of the advantages of a good washer. It removes all traces of tar, so objectionable in covering the filling of the scrubber, and preventing the gas getting in contact with the wet surfaces on which its efficiency depends, or in getting forward to the purifiers. It freely absorbs ammonia, and also carbonic acid and sulphur; and requires no attention or labour farther than running off the strengthened charge and refilling as required. A form of such a vessel, possessing some novel and effective features, I have recently devised.

Ammoniacal liquor, strengthened by the processes just described, contains a large quantity of sulphide of ammonium, which has the capacity of combining with sulphuretted hydrogen, and, in a higher degree, with carbonic acid. And when it is borne in mind that, while every 1000 measures of crude gas from Newcastle coal contains 1½ parts of ammonia and 8 parts of sulphuretted hydrogen, it contains no less than 25 parts of carbonic acid (and presumedly gas from American coals, always excepting Nova Scotia coal, does not differ greatly from these proportions), it will be seen how important the arresting of these impurities, particularly the carbonic acid, is in the further purification, and by means requiring practically no manual labour, and, at the same time, furnishing a valuable commodity.

Purifiers.

The further and final purification of the gas may be effected either wholly with lime, partly with lime and partly with oxide of iron, or with oxide only. Perhaps the best method is to have one, or, if preferred, two boxes, but not working in rotation with the others, for the absorption of the carbonic acid still left in the gas, and the others worked with oxide for the sulphuretted hydrogen. In this country, where happily the bisulphide of carbon bugbear is unknown, the order of lime and then oxide, or *vice versâ*, is of little moment.

Perhaps nothing has struck me more forcibly, in gas matters in this country, than the limited use, as I understand, of oxide of iron in purification. Its economy, as compared with lime, seems to me to be as indisputable as its freedom from the noisome effluvium of foul lime, the disgusting odour from which pervades the neighbourhood of gas-works when a purifier is emptied, and may be said to be chiefly answerable for the popular prejudice against living in their neighbourhood.

As to the relative economy of oxide as compared with lime, I may state that the total cost for six successive years at Sydenham averaged ·34 of a penny, but say, in round figures, a halfpenny, or one cent per 1000 cubic feet. In that case it must be understood that the account was credited with the receipts for spent material which is readily sold in England, when it contains about 40 to 50 per cent. of sulphur, for the manufacture of sulphuric acid; and for that reason the cost is necessarily higher here, there being as yet no market for the used material.

But even at Montreal the cost of purification last year was only 1 and 6-10ths cent, but say roundly 1¾ cent per 1000 feet. It should, however, be explained that the coal used exclusively (with a per centage of Cannelton cannel) was Nova Scotian, which is so charged with pyrites as to contain at least twice or three times as much sulphur as Newcastle, or I suppose the average of American coal. In both instances the cost was doubtless considerably reduced by the previous copious washing of the gas, by which from 30 to 50 per cent. of the carbonic acid and sulphur may be eliminated.

Photometry.

In making photometric experiments, counterpoising the candle in a pan of the scales before lighting, warming the wick at a gas-burner, so that it may attain its maximum light as soon as possible, instantly lighting it as the clock strikes at the expiration of ten minutes (when the observations have been taken), extinguishing it the moment the clock strikes, and then ascertaining the consumption of sperm, is a mode, I suppose, now seldom practised. If it is so in any case, it should be abandoned, because the candle cannot at first be in a proper state of burning, and consequently the first few readings of the photometer will be much in excess of the real comparative value of the gas. "The real lighting value of a candle may be considered as the average of its light during the whole time it burns, and as the average of its light during the first ten minutes after ignition would be undoubtedly considerably lower than the average for the whole time during which it is capable of burning, it is manifestly unfair to employ the candle under the conditions mentioned."

But even the more usual practice of counterpoising the candle or candles after attaining the maximum light, removing to the photometer, and at the end of the ten minutes extinguishing, and again removing to the scales, to ascertain the loss of sperm, may be advantageously superseded by a much simpler method. It is objectionable from there being the possibility, in moving the candle or candles about, of dropping sperm, and so vitiating the experiment, and of entailing too much trouble in manipulating with fractional parts of grains in weighing. The more cumbersome the experiment, the seldomer is the photometer-room likely to be visited; simplicity in this, as in other apparatus and experiments, being a desideratum. I would therefore eschew all such grand-sounding complications as electric clocks, electro-magnet thermometers, &c., which, in my opinion, in the practice of photometry, are entirely unnecessary.

The instrument I prefer is what is known as the Letheby-Bunsen photometer, those I use having certain improvements made by Mr. Hartley, of Messrs. Alexander Wright and Co., of London. The bar is 60 inches in length, carrying a saddle slide provided with four rollers to ensure easy motion, and which support an improved disc shade fitted with reflectors. There is the usual experimental wet meter, and a delicate wet governor, the pipe from which to the burner being furnished with a micrometer cock. There are also black wooden screens behind both the burner and candles, and similar screens near each end of the bar, interposed between the burner and candles respectively and the disc, each having a central hole for the rays of light to pass through to the disc. The screens behind the burner and candles prevent the rays of light from their respective flames falling upon objects from which they would be likely to be reflected back to the disc; while the ones in front of the respective lights shield the operator's eyes from the direct rays of the flames, so that, being in comparative darkness, he is better able to decide upon the illumination of the sides of the disc.

Another recommendation is the employment of two candles instead of one, or rather half candles, the one burning from the smaller and the other from the thicker end, by which any variation in burning, or in the intensity or power of their respective lights, is mutually corrected. A stronger standard light, too, is obtained, rendering easier the fixing of the point of equality, and enabling the operator to work over a wider scale—*i.e.*, over divisions nearer the centre of the scale, thus compensating (except in testing very rich gas) for the closer divisions than on a 100-inch bar.

But perhaps the most important improvement as regards both facility and accuracy is that of weighing the candles, by a fixed sensitive scale, while burning, and in a proper position for experiments. By this means all trouble of moving them, and of manipulating with grains and fractional parts, is obviated. The candles having attained their maximum light, the gas burning at the rate of exactly 5 cubic feet per hour, and the candles nearly counterpoised, the minute hand of the clock is noted, and the second beats counted on, until, from burning, the candles become lighter, and the pointer of the balance reaches the centre of the index, at which moment a 40-grain weight is dropped into the pan under the candles, and the observations proceeded with. Before the expiration of the ten minutes the position of the clock is again noted, and the seconds counted on, until the balance turns, and its pointer again reaches the centre of the index.

It will be thus seen that instead of the weight of sperm burnt in ten minutes, as in the usual way of correction, in this case it is the length of time occupied in burning 40 grains (20 grains by 2 candles). By the former method it is a variable consumption of sperm in a given time; in the latter it is a given consumption of sperm in a variable time.

But mark the ease of the correction for any deviation from the standard consumption. It is only necessary to multiply the average observed illuminating power of the gas by the standard time of the consumption of the 40 grains of sperm—viz., 10 minutes or 600 seconds—and divide the product by the number of seconds it took to burn the 40 grains, the quotient being the corrected illuminating power of the gas.

That this principle is correct a moment's reflection will show, because if the candles are burning at less than the standard rate, the observed will be in excess of the actual illuminating power of the gas, because it is compared with a light less than the standard light. But the candles burning at a slower rate than two grains each per minute will have taken longer than the standard time of 600 seconds, and as the standard is the constant multiplier and the actual time the divisor, and the latter in such case being greater than the former, the excess of the observed illuminating power is reduced and corrected. On the other hand, should the consumption of the candles be slightly in excess of the standard, the time of consuming 40 grains will be less than 600 seconds, and the observed illuminating power of the gas, from becoming tested against a light of greater intensity than the standard, will be less than its actual illuminating power; but the divisor in this case being less than the multiplier, the quotient will give the increased and corrected illuminating power.

I have alluded to a clock, and it will be understood that I refer to a substantially made and accurate pendulum clock, hung on the wall, giving seconds dead beats, and striking each minute, after giving five seconds warning. With such a clock, the eyes of the operator are occupied only with the meter, in obtaining the standard consumption of the gas, and the candles balance in counterpoising, the ears taking the time from the distinct dead beats of the clock and the minute strokes.

The arrangement I prefer is to have the meter and candles balance at the right-hand end of the photometer-bar, and near the wall of the room to the right of the operator, the clock being hung on the wall, and in a line with where the operator stands. By this arrangement it is only necessary to note the time when the weight is dropped into the candles pan of the balance, leaving the mind quite free with respect to noting the time when the 40 grains are burnt, because, while keeping the eyes on the balance pointer when it begins to swing, the pendulum can be stopped by the operator's hand, without shifting his position, the moment the balance is equipoised.

With these appliances, I believe greater accuracy is secured than by the other processes, the operation being at any rate simplified. I have not alluded to making corrections for temperature and pressure, because, in the ordinary way of testing, I think it unnecessary, the consumers burning the gas under the same atmospheric conditions.

[The report of the further proceedings at the meeting is reserved for next number.]

NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

Health Section.

(*Continued from page* 706.)

NOXIOUS VAPOURS.

Dr. Angus Smith, of Manchester, read a paper on the question—"What Amendments are Required to Prevent the Evils Arising from Noxious Vapours and Smoke?" He said that the progress of chemical manufactures, and the alkali manufacture pre-eminently, were intimately connected with the progress, civilization, and refinement of the country. It was enough to say that soap, glass, clean white linen and cotton, and writing-paper demanded the existence of these works. But it was said that they destroyed crops, trees, and vegetation, and this charge was not without foundation. Trees had been destroyed to a pitiable extent in many places, and their decay was always going on. In a statement made to the Royal Commission in 1863, it was stated that the capital of the alkali trade in the kingdom was equal to about £2,000,000, the total amount of salt used being annually 254,000 tons; now nearly that amount was used in the crowded collection of works at Widnes, whilst that was only 39 per cent. of the total used by the whole trade. It was needful to consider the actual nature of the damage done to the land. They must remember that that was not a money loss, except perhaps in a few cases. He had never heard of any piece of land selling at a diminishing rate because of chemical works in Lancashire, but he had heard of a great deal selling at a much increased rate. So far as could be made out under the new Act crops had suffered very little, and in places were they used to suffer there were no complaints this year. Landowners might still, however, say, "We know you do us good by increasing the value of land, but why do us evil to counteract it? Send all the chemical work to some corner by themselves, and let them rage together." Such a proposal might once have been reasonable, but it was now out of all question. It was completely made out that the sulphur acids from chemical works now far exceeded the muriatic acid. The sulphur from common coal was a very large quantity, and when chimneys were numerous and near, the amount given out was very destructive, so that, for example, near the centre of a town, such as Manchester, trees would not grow at all. They burned about 100 million tons of coal annually, and if it contained one per cent. of volatilized sulphur they had 3 million tons of the strongest vitriol poured into the air, most of it coming down on themselves and the land. The combustion of smoke, that was of the black portion, was very desirable. It was known to be very easy in most cases, and the introduction of mechanical stokers was a duty in very many cases, probably for the majority of furnaces. It was very much wanted for the benefit also of the stokers, who, especially in sea vessels, were exposed to labour such as ought not to be given by a nation that rejoiced in putting down slavery. Condensation in alkali works was advancing so rapidly that it might even now be considered advisable that it should be completed in all new works from this time, and certainly so if the newer furnaces acted as they promised. The difficulties as to copper works were greatly removed, and it would be no hardship to insist that every copper worker should condense at least as well as Messrs. Vivian or Messrs. Newton and Co. did. They might then think of the gases of glass-works. At present he believed they were quite able to deal with those of potteries and cement works. The actual effect of any of these gases on the health of the population was not well known. They did not prevent to any known extent the existence of zymotic diseases, as some persons very naturally expected. The gases were not strong enough to prevent infection, and the total effect in a chemical town was not clearly known. In St. Helen's the mortality last year was 23·9. Still the evidence seemed to be against the gases, and very clearly in the case of the workmen. Gases, from putrefaction, were better known to be hurtful to health, but people did not avoid them so much, because they did not affect the senses so readily. It was better to prevent the formation of gases near them than to remove them when found. After giving a description of furnaces and various processes, Dr. Smith said all works giving out offensive gases ought to be put under inspection for a time, when complained of, and all those giving out the acids mentioned should be included under constant inspection. Certain facilities should be given in the case of actions for damages, so as to include a number of persons as doing an injury, and persons should pay in proportion to the injury, so far as could be ascertained.

Dr. Andrews, President of the British Association, said that the presence of the foreign bodies in the atmosphere, to which Dr. Smith referred, was, undoubtedly, injurious to the public health, and that the prevalence of smoke in the air of large towns was especially hurtful from intercepting the solar rays and thus preventing their vivifying influence upon the human frame, as might be seen from the pallor of the habitual denizens of our great centres of population. As an example of the influence of hurtful emanations, he referred to the effects of mercurial vapours at the mines of India, where the young workmen died prematurely, and those who survived were affected with mercurial palsy.

Dr. Macadam (Glasgow) said that the only objection he had to Dr. Smith's paper was that it dwelt more upon persuasion than compulsion with reference to the consumption of smoke, and he thought a little compulsion along with the persuasion would be more effective in purifying the atmosphere.

Dr. Fergus (Glasgow) remarked that sewer gases found their way into all our houses in spite of any trap which had been invented; and these gases were sufficiently potent to destroy the lead soil-pipes between the trap and the house. He found that the trap of the closet was a small laboratory for the manufacture of a gas that destroyed the lead, and stated that none of the gases were kept out of the houses by what were called water-traps.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(From our own correspondent.)

The dulness of trade generally is growing worse every week, either by reason of the political crisis, or the positive lack of enterprise which characterizes every branch of commerce. On all sides one hears repeated complaints, and there are everywhere evidences of the exceedingly bad state of things. At the east end of Sheffield itself, where all the large iron-works are, there are hundreds of houses empty, the men having left the town, or having gone three or four families together into one house in order to save expense. Such dwellings as are occupied are being let at decreased rents, in order to keep the tenants in them. Financially, too, matters are very bad, money being most difficult to get in. On Thursday, Mr. Alfred Allott, an accountant at Sheffield, colliery proprietor, iron-works partner, iron ore-mine owner, and tin-mine partner, filed his petition in the local Bankruptcy Court with liabilities amounting to £210,000, and assets roughly estimated at £170,000. Mr. Allott's difficulties had long been publicly

known, and it is only after a hard struggle that he has succumbed—a result owing to the dulness of trade, and an unfortunate embarkation in an American iron and coal purchase.

Just outside the town I notice that the number of furnaces in blast has been reduced, with the evident intention of keeping up prices by not over producing. Some consumers, as well as producers, have large stocks of pig on hand. Although there is a fair sale of brands suited for foundry purposes, local quotations are nominally unchanged. "Aireside Leeds," No. 1, is 56s.; No. 3, 52s.; and No. 4, foundry, 51s.; forge being 50s. per ton. North Lincolnshire brands are steady at 60s. for "Redbourn," No. 1, 56s. for No. 2, 54s. for No. 3, and 54s. for foundry.

Fuel is still abundant, and is almost certain to remain so during the whole of the winter; seeing that the collieries even now are not working full time, and cannot dispose of their output at current prices. Steam coal is quiet, and from time to time I continue to hear of the renewal of gas coal contracts at prices which are not unfavourable to buyers—say, from 6s. 6d. to 9s. per ton at the pits.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

A steady trade continues to be done in all good classes of round coal, and prices are well maintained, the best sorts having a tendency to harden, although it is only in one or two cases that any actual advance has been made, the Tyldesley colliery proprietors having advanced their pit prices for first and second qualities of coal about 6d. per ton within the last few days. For best Wigan Arley about 11s. to 12s. per ton at the pit mouth is asked, and for Pemberton four-feet 9s. to 9s. 6d. per ton is about the average selling price, although 10s. per ton is in some cases being quoted. In gas-making coals, so far as the home demand is concerned, there is very little fresh business doing, and prices are nominally without alteration. A considerable amount of gas coal, however, is being shipped; and for good round gas coal, free on board at Liverpool, about 14s. per ton is the average quotation. Common qualities of coal are without any material alteration, except that the increased demand for the better sorts suitable for house-fire purposes enables colliery proprietors to maintain their prices better than they have been doing of late. Common steam coal, however, is still difficult to sell, and for shipping purposes extremely low prices have to be accepted. Good qualities of burgy move off pretty freely at about late rates, but supplies are more plentiful, and there is a weakness in the inferior descriptions. Slack is still a drug, and the increased activity in round coal is throwing large quantities on the market, for which there is no proportionate demand from consumers, and considerable stocks are accumulating in some quarters, whilst extremely low prices are accepted to effect sales, fair qualities being offered freely at 3s. per ton at the pit mouth.

For coke there is rather more inquiry, but prices show no improvement, and for delivery into the Manchester district remain at 12s. to 14s. for common, and 18s. to 20s. per ton for best coke.

In the iron trade of this district prices have a stiffening tendency, and sellers are very cautious about entering into forward engagements. The Lancashire makers of pig iron have secured a few good orders for prompt delivery at full prices, which are keeping them fairly employed for the present, but they are not at all disposed to quote for forward delivery. For immediate delivery into the Manchester district their prices remain firm at 56s. to 57s. per ton for No. 3 foundry, and 55s. per ton for No. 4 forge. Middlesbrough iron is stiffer, and there is very little offering except for immediate delivery. In the finished iron trade some good orders for bars have lately been secured in this district, and makers are firmer, some of them asking an advance of 2s. 6d. per ton upon their late prices. The average quotations for delivery into the Manchester district are about £6 12s. 6d. to £7 per ton.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The arrivals and sailings of vessels to and from the northern coal ports within the past ten days have been active. The weather has been tolerably satisfactory, and there has been no impediment in that respect. Within a fortnight 167,556 tons of coals were shipped from the Tyne Dock. Most of these were gas. The demand for best gas coals is very well sustained. The shipments are likely to be supported till the end of the year; 10s. per ton is the rate for best gas coals, and they are very firm at that figure. Second-class gas coals were not quite so steady in price during last week; though upon the whole the Durham pits wrought tolerably well. House coals were about 11s. 6d. per ton on the Tyne, and a number of small cargoes were shipped. The steam coal trade of Northumberland is now very dull; prices are not so good as they were, and the collieries will not make half time. The winter prospects are not very satisfactory, and some of the second-class pits in Northumberland will in all probability be laid in.

The freight market has not changed very materially since last week. Small ships have been taken up by the brokers as they have arrived, and recent quotations have been fully sustained. The demand is likely to continue for some time, as small cargoes of coals are needed on the southern coast. Coal freights to France have gone up about 7s. per keel. The rates paid steamers in the coasting trade are—London, 5s. to 5s. 3d.; Rochester, 5s. 6d.; Portsea, 6s. 6d.; Southampton, 6s. 3d.; Dublin, 8s. 6d. to 8s. 9d. per ton; Hamburg, £7 15s. per keel. The Baltic trade is nearly over, and as the steamers arrive home they will be put into the coasting trade, so that we may expect an ample supply of this class of tonnage for the remainder of the year. The Mediterranean business is very well kept up for the better class of steamers. Home rates continue to be high.

The iron trade of Cleveland and the North of England improves slowly but steadily. The little advance made upon prices does not go back, but is sustained. The prospects for next year seem fairly satisfactory, and local industry, which has been so dreadfully depressed in Middlesbrough and the district, seems to be reviving.

The chemical trade of the Tyne has continued in an excited condition since our last. Speculators seem to believe that this business will get better with the turn of the year, as they are anxious to make contracts at a tolerable advance upon recent quotations for certain classes of goods for the whole of 1877.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

The question of differential gas-rates, which was settled in Glasgow several months ago, is now exciting some attention in Kilmarnock, where the gas supply is also under the municipal authority. During last year the item of discount to large consumers amounted to £139 3s. 8d., and there is now a disposition to question the legality of continuing the differential rate, seeing that the manufacture of gas is conducted by the Corporation Gas Commissioners for the benefit of the ratepayers at large, and not for their own private advantage, as was the case when the gas company had the undertaking in their own hands. The discount allowed then ranged from 5 to 15 per cent.

At the meeting of the Town Council of Dumbarton last Wednesday evening, it was resolved, on the recommendation of the Corporation Gas Committee, to reduce the price of gas 6d. per 1000 cubic feet, which is the second reduction since the gas undertaking passed into the hands of the corporation. On the motion of Bailie Buchanan it was also resolved to make an increase of £20 per annum to the salary of Mr. M'Gilchrist, the manager of the gas-works.

The improvements that have for several months been in progress at the works of the Irvine Gas Company, are now about completed. A large retort-house has been built, and 24 new retorts provided, which are capable of manufacturing 150,000 cubic feet of gas per day. At present the consumption is 70,000 cubic feet per 24 hours. The whole expense of the new works will be upwards of £2000.

The *Scotsman* newspaper has lately been induced, through the receipt of a communication in a letter from a correspondent, to direct attention to the question of "Wet *versus* Dry Meters." After summarizing the letter, the *Scotsman* writer goes on to say: "Without presuming to pronounce on the respective merits of the rival systems, we are inclined to agree with our correspondent that at all events the public should be left free to decide, each householder for himself, what sort of meter he will rely upon. If it be true, as is averred, that dry meters are foisted upon families merely to bolster up defective fittings, the sooner an efficient inspection of fittings is instituted the better alike for the producers and the consumers of gas. And were that once done, the competing meters would be sure soon to find their proper level, there being no longer a makeweight against one and in favour of another in the irritating nuisance of jumping lights."

During the week ending Nov. 18, the maximum illuminating power of the Glasgow gas ranged from 27·82 candles to 29·58 candles. The average illuminating power of the gas made at the Tradeston station was 28·30 candles, and that made at the Partick station was on one occasion down as low as 24·72.

Mr. J. Falconer King reported to the last meeting of the Town Council of Edinburgh that the gas supplied to the city on Wednesday, Nov. 8, by the Edinburgh Gas Company had an illuminating power of 28·34 standard candles, while that of the Leith Company was 24·90 candles.

There have been further changes in the value of Glasgow Corporation Gas Annuities during the past week. On Tuesday the 9 per cent. annuities fetched £1 10s. more, at 220. Later in the week the 6¾ per cent. annuities were inquired for at 164—a rise of 20s.—without bringing forward sellers.

An action-at-law was called last Tuesday, in the Court of Session, before Lord Young, at the instance of the Dundee Water Commissioners, against Messrs. Thomas Edington and Sons and Messrs. D. Y. Stewart and Co., pipe-founders, Glasgow, and Mr. J. W. Stewart, C.E., Edinburgh. The object of the action is to have Mr. J. W. Stewart prohibited from acting as arbiter in any dispute which may arise under the contract with the commissioners to supply the piping in connexion with the Lintrathen water supply.

The local authority of the united parishes of Dunoon and Kilmun are applying for a Provisional Order to have a special water supply district created for Sandbank, a watering-place on the Clyde.

At the last meeting of the Falkirk Police Commissioners it was agreed, in compliance with recommendations from the Water Committee, to endeavour to obtain an addition to the supply, by making an artesian well near the Lower Fountain of the existing supply, and likewise by raising the embankment in the lower ground where the water is stored, with the view of increasing the quantity stored.

The Perth Water Commissioners have appointed a committee to consider the whole question of applying to Parliament for increased powers, the said committee to confer with the promoters of the scheme already before the public.

Since last report prices of pig iron have gone up still further, the closing quotations on Friday being 59s. 6d. twenty days open, buyers 59s. 4½d. cash.

The supply of coal is very abundant, and prices remain practically unaltered.

DEATH OF MR. C. B. DARWIN.—This gentleman, who was manager of the gas and water works at Ulverston, died suddenly at his residence in that town on the 19th inst. He was only 31 years of age.

SANITARY WORKS AT KIDDERMINSTER.—At the meeting of the Association of Municipal and Sanitary Engineers and Surveyors, on the 3rd inst., Mr. Comber, borough surveyor at Kidderminster, read a paper descriptive of the sanitary works at Kidderminster, which were carried out by Mr. Fairbank, of London. The area drained was 1100 acres, and the population contributing sewage 20,000. The whole of the surface water was conveyed into the sewers through cast-iron gullies, in the centre of the streets. These originally had boxes filled with charcoal all of which were trapped. The ventilation was effected by means of open gratings placed in the shafts, and so long as these existed, great complaints were made of the smells arising from the drains. The whole were removed, and the working of the ventilation was now satisfactory. The flushing was effected by means of hose from the water-mains, but, during the last few months, he had constructed a self-acting flushing apparatus, which discharged a sudden flush of from 50 to 100 gallons of water twice in 24 hours, or oftener if required. These he proposed to place at the dead ends of all branch sewers. The sewage was collected into two tanks, each 100 feet by 27 feet, and each containing about 130,000 gallons. These were provided with straining gates to intercept yarn waste and other extraneous matter likely to choke the pumps. After flowing through these tanks, the sewage entered the engine-wells, from whence it was pumped through an 18-inch main, to a height of 98 feet, on to the sewage farm four miles distant. The ordinary dry weather flow of sewage was about 1,120,000 gallons in 24 hours, and in wet weather about 1,900,000 gallons. In heavy thunderstorms it was sometimes as much as 600,000 gallons per hour. Each engine was capable of raising 1,400,000 gallons in 24 hours. The storm-pumps were capable of raising 5000 gallons per minute each. The detritus and sludge which precipitated in the tanks had to be removed by manual labour, and cost about £80 per year. It was sold to the neighbouring farmers at 1s. per cartload. The cost of pumping, cleansing, and maintaining sewers was about £700 per annum. The sewage farm was at Stourport, and comprised 172 acres. The soil was a light sand, 5 to 6 feet deep, on a bed of gravel. The natural drainage through the gravel was so good that the effluent reached the main drain without difficulty, was conveyed into the river or canal at pleasure, and passed off perfectly colourless. The farm was originally carried on by the corporation, but, finding it to be an annual loss, it was let, in October of last year, for 14 years, at £3 per acre, or a total of £500; so that the actual cost of disposing of the sewage was £200 per year (this, of course, was not taking into consideration interest on outlay). The total cost of the construction of the whole of the sewerage work was £74,754, including £17,999 for purchase and laying out of the sewage farm. The water-works were constructed about the same time as the sewerage works. The well would yield about one million gallons in 24 hours. The pumps would raise 630,000 gallons in 24 hours, and the present consumption was 250,000 gallons in that time; this was steadily increasing. The cost of constructing the works, including the laying of mains, was £24,765, making a total of £99,519 expended in sanitary works since 1869.

SANITARY WORKS AT HEREFORD.—At the meeting of the Association of Municipal and Sanitary Engineers and Surveyors on the 3rd inst.—Mr. G. Cole gave a sketch of the sanitary arrangements of Hereford. That city and its suburbs contained a population of nearly 20,000, but there were not more than 10,000 or 12,000 within the district of the sewerage and water supply. The works were carried out under the direction of Mr. T. Curley, C.E., in 1854, but had been considerably extended since, under his (Mr. Cole's) direction. There was scarcely a house in the city which was not connected with the sewers, all had their water-closets, and nearly all were supplied with the sanitary syphon and trap system, with self-closing valves, and were supplied with water direct from the mains. The surface water was conveyed into the sewers, and, when running full, flushed them effectually after heavy storms. At other times they were flushed weekly by flush wells at the end of every street. The sewers were all well ventilated by open gratings in the centre of the street, varying from 50 to 100 yards apart, and no complaints had ever been made of bad smells from these openings. The sewers were further ventilated by rain-water pipes when

these were not near windows, and in some instances by special 6-inch pipes. The cesspools were for the most part filled up. It had often been his lot to find two or three at gentlemen's houses, and Mr. Cole commented on the danger arising when the imprisoned gases escaped into a house. All sewers and drains should be ventilated as much as possible, and no drain in connexion with a sewer should be allowed to enter a house without there being carried up from it a perfectly jointed ventilator. Water-closets should be made outside the external walls of a house, or at any rate adjoining them, so as to admit of free ventilation, not only from the closets themselves, but from the soil-pipes below the traps. The water-closets in many instances in Hereford were not properly ventilated, and Mr. Cole remarked that the better class of society ran more danger from this source than the poor. Earth closets had been used, but not found successful—it might be through mismanagement. The inspector had been compelled to report them as nuisances, and had caused them to be made into water-closets. The great drawback to the Hereford sewerage was that it was made to empty itself into the Wye and polluted the stream for a considerable distance. The commercial value of sewage was, he thought, generally much over-estimated, but in an agricultural district, if anywhere, it ought to be utilized. The water supply of Hereford was pumped from the Wye, passed through filter-beds, and delivered in the usual way. Mr. Cole commented on the waste of water which occurred and the great unnecessary expense this entailed on the ratepayers. With the object of checking it at Hereford, he had recommended the town council to make the use of water-meters compulsory as far as possible. He tested for a week the quantity of water passing through the meter at the water-works in each of the four hours ending at four a.m., and the average was:—One o'clock, 19,805 gallons; two o'clock, 18,000; three o'clock, 17,571; four o'clock, 17,500. It was obvious that the legitimate use of water at these hours would be very small, as he had no evidence as to material breakage from the pipes, and he was bound to conclude a considerable number of taps were left open, and waste caused, from which no one derived benefit. Many persons thought they flushed their drains by so doing, but a drain could only be effectually flushed by pouring a quantity of water suddenly into it. A discussion took place upon this paper, and Mr. Cole, replying to criticisms upon it, supported his plea for the general use of water-meters. Years ago the same objections were made to the general use of gas-meters as were now made to water-meters; but at the present time gas-meters were used by all consumers. He hoped something would be done to teach people the value of water, and nothing would tend more to this than the adoption of the meter system.

Register of New Patents.

121.—MARCHANT, G. M., Huddersfield, "*Improvements in steam and water taps or stopcocks.*" Patent dated Jan. 11, 1876.

This invention consists of a self-acting adjustment of the stopcock or tap, which renders it always tight, and is applicable to taps or stopcocks having taper plugs.

A hollow chamber is formed in the larger end of the plug, and into the casing containing it is screwed or otherwise fixed a corresponding cover, which may be made chambered. The chamber in the plug, together with the cover, form a box, wherein is inserted a spiral spring, which being sufficiently compressed by means of the cap or cover, retains the plug down in its required position in the case. As the plug and casing wear in their working parts, the spring forces the plug and keeps the wearing surfaces of it and the casing together, preserving the tap or stopcock steam or water tight. There is also provided a passage from the steam or water-way in the casing into the spring box, by which means a pressure of water or steam can be brought to bear on the plug, and act as a help to the spiral spring.

132.—CROSSLEY, F. W., Manchester, "*Improvements in gas motor-engines.*" Patent dated Jan. 12, 1876.

This invention relates to improvements in gas motor-engines of the kind described in patents No. 434, Feb. 12, 1866, No. 2245, Aug. 3, 1867, No. 605, Feb. 18, 1874, and No. 3205, Sept. 19, 1874.

In the engine therein described, a piston was raised in a cylinder a little distance, drawing in an explosive charge of gas and air, which being ignited propelled the piston along the cylinder without doing work, the work being performed by the return stroke of the piston, consequent on the atmospheric pressure acting against a partial vacuum produced under it. In starting such engines it has hitherto been necessary for drawing in the first explosive charge to turn the fly-wheel and its shaft by hand, or otherwise, in order to effect the movement of the slide-valve and the partial raising of the piston by means of the gear provided for that purpose, but according to the present invention this is dispensed with, by providing means for moving the gear that raises the piston and works the gas and air slide-valve independently of the fly-wheel shaft.

Various contrivances may be employed for so moving the gear; thus according to one arrangement the crank of the small crank-shaft described in Patent No. 3205, of 1874, is provided with a stud at its end, upon which there is loosely fitted a loop at the one end of a chain which is wrapped round the side surface of the crank, and is connected at its other end to a lever having its fulcrum on the engine framing, so that by pulling the chain by means of the lever the crank and its shaft will be rotated, and the piston and slide consequently moved as required. The crank-shaft having thus been caused to revolve sufficiently far to admit and fire a charge of gas and to start the engine, on its continued revolution the loop of the chain will drop off the stud, and thus leave the apparatus free to continue working.

According to another arrangement, there is fixed on the crank-shaft a toothed pinion, and a lever having its fulcrum on the engine framing, provided with a toothed segment at one end, which is put in gear with the pinion, so that on moving the other end of the lever by hand the crank-shaft will be rotated. The lever is moved until the toothed segment is out of gear with the pinion, thus leaving the shaft free to continue in motion; or a toothed wheel may be provided in gear with the pinion, and rotated partially by a ratchet-lever, or other suitable contrivance, when required to start the engine.

137.—LAW, H., Adam Street, Adelphi, "*Improvements in air-vessels, valves, and regulators for the supply of water to water-closets, urinals, and lavatories, which are also applicable to other purposes.*" Patent dated Jan. 13, 1876.

By air-vessel the inventor declares himself to mean a vessel of any convenient form, the upper part of which is filled with air, which being compressed when water is forced into it by the pressure of the water in the supply-pipe regulates and determines the quantity of water admitted, and at the same time conserves the force due to that pressure, and again ejects the water with a velocity and force due to such pressure.

The first part of this invention consists in dividing such an air-vessel vertically into two portions, so connected that the water shall enter both compartments with equal facility, but shall be retarded or delayed in being ejected from the compartment furthest from the supply-pipe; the object being to allow a certain portion of the water to be freely and rapidly discharged, while the remaining portion shall not be discharged until the outlet-valve, pan, or plug, has been closed, so that it shall remain in the closet or basin, to seal the outlet, and leave the closet or basin in a fit state for further use.

The second part consists in so constructing the valve, by means of which the air-vessel is alternately placed in communication with the supply-pipe and with the closet-pan or basin, that it shall be impossible for any portion of the water, however small, to pass direct from the supply-pipe into the closet-pan or basin. This is effected by having two independent valves, one to close the inlet supply-pipe, and the other to close the outlet-pipe leading to the closet or basin, and by so connecting these two valves with a lever having no fixed fulcrum that each of the valves shall alternately become the fulcrum of the lever when it is opening or closing the other valve, the whole being so arranged that the pressure of the water in the supply-pipe ensures the valves opening and closing in the order required, and further ensures each valve closing previous to the other opening.

The third part consists in an apparatus for regulating the rate of closing of the valves, and which is equally applicable to regulating the rate of speed of any part of a machine required to move continuously through a limited space with a given rate of speed. It consists of a cylinder closed at one end, and having a piston formed by a cupped leather capable of moving within it, the cupped leather being so arranged that it will allow the piston to be pushed easily, and without resistance, until in actual contact with the closed end of the cylinder, the air within escaping freely round the yielding sides of the cupped leather. Upon applying any force to withdraw the piston from the closed end of the cylinder, such force will be opposed by the pressure of the atmosphere upon the outer surface of the piston, which will press the cupped leather into contact with the cylinder, and so prevent the entrance of any air between the piston and the cylinder. Under these circumstances the piston can only be withdrawn by the admission of air into the closed end through some one or more apertures made for the purpose, and by the size and position of these apertures the movement of the piston can be regulated and controlled as may be desired. The piston being connected with the valve or other part of a machine, the rate of movement of the latter will be controlled and regulated by that of the piston itself.

157.—HOWARTH, T., Rufford, Lancs, "*An improved tap for drawing off and measuring liquids.*" Patent dated Jan. 14, 1876.

This tap is constructed with a hollow plug which will form in itself the measurer for the quantity of liquid required to be drawn off. It is of conical form, and fits into and turns in a conical-shaped chamber (ground to receive the plug), which forms part of the body of the tap. The outer end of this chamber is closed by a screw-cap, or in any other convenient manner, and to the outer end of the hollow plug is attached a stem or rod, which projects through a water-tight packing in the screw-cap of the chamber, and to the outer end of it a handle is attached, wherewith to turn the plug. The conical chamber and the hollow plug are both provided with suitable inlet and outlet openings and air holes, which are so arranged that while the inlet opening is open and the plug is being filled, the outlet opening is closed, and *vice versâ*. If desired the liquid may be drawn off without measuring through openings in the hollow plug suitably placed for that purpose.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

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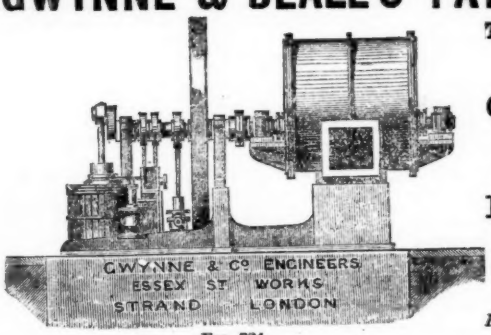

FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

GWYNNE & CO.

HAVE MADE THE

LARGEST AND MOST PERFECT

EXHAUSTING MACHINERY

Ever produced, and the most economical in working.

Prices and every information on application.

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

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G. & Co. are now manufacturing for a London Gas Company three of their 210,000 *cubic feet Patent Gas Exhausters, and many of all sizes.*

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ANNUAL ACCOUNTS
OF
GAS COMPANIES.

FORMS OF ANNUAL ACCOUNTS, arranged as required by the 35th Section of the Act (34 & 35 Vict., cap. 41), are now ready.

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SPENT OXIDE OF IRON.—Arrangements to take a regular weekly supply can be entered into. Ten tons, averaging 50 per cent. of sulphur, are required at once.

Apply, stating price, to R., care of James Beattie, Esq., Solicitor, 1, Poet's Corner, WESTMINSTER, S.W.

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Now ready, price One Shilling, No. 1 (*to be continued Monthly*) *of*
A TREATISE ON THE SCIENCE & PRACTICE
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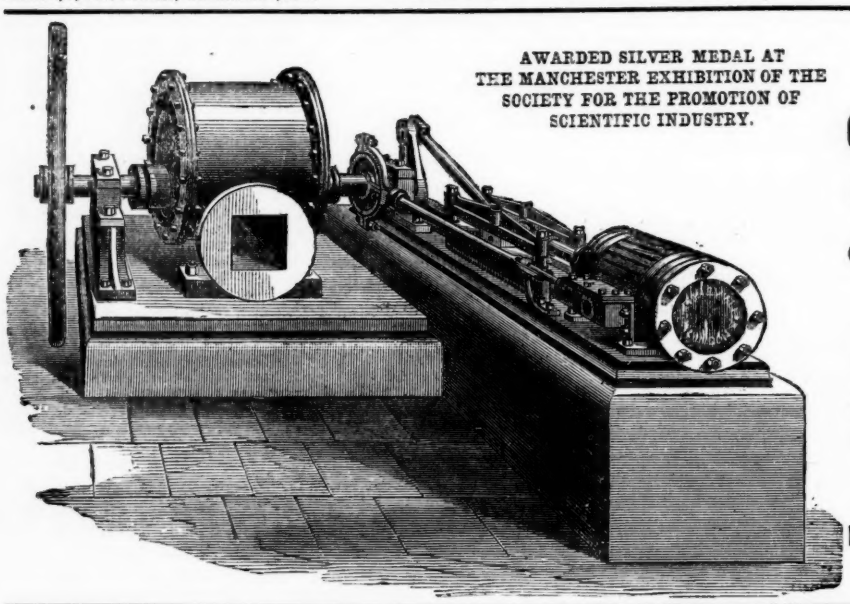
As the "Treatise" is printed in a very superior style, and will contain numerous engravings on thick paper, it cannot be sent through the post without damage. Our friends will therefore have to order the numbers through their local booksellers, by whom they will be regularly supplied.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET.



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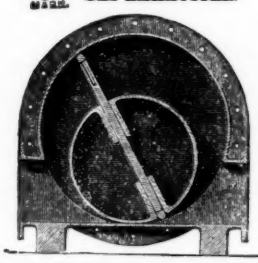

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B. D. & Co. also make Steam-Engines to drive Gas Exhausters direct or otherwise, and Gas-Valves.

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WANTED, a good Gas-Fitter and Meter REPAIRER. Must be steady.

Applications to be sent to the MANAGER, Gas-Works, SOUTHPORT.

WANTED, Spent Oxide. The Sheffield Chemical Company, Attercliffe, are prepared to PURCHASE large or small quantities.

Address, with particulars, the Proprietors, HORNBY, FAIRBURN, AND Co.

TO GAS ENGINEERS AND GAS APPARATUS MAKERS.

WANTED, one or two Gasholders, con- tent 800 to 1000 cubic feet. Second-hand would suit.

Address, stating price and full particulars, H. L., 4, BROAD SANCTUARY, S.W.

WANTED, a Gentleman, qualified to act as MANAGER, or Managing Director, to a Manufactory of Coal Tar Products. The applicant should be prepared to become personally interested in the business by the investment of a moderate sum. First-class references required.

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WANTED immediately, in a provincial Gas-Work, a young Man from 18 to 24 years of age as LEDGER and RENTAL CLERK. He must have been accustomed to the routine of a Gas Office. One such with a knowledge of chemistry will be preferred.

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WANTED immediately, in a large Pro- vincial Town, a steady, respectable Man as METER INSPECTOR and Repairer. He will be required to take the indices quarterly, inspect private fittings, and make himself useful.

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GAS AND WATER MANAGER.

NOTICE is hereby given that the Ulver- ston Local Board require a properly qualified person to undertake the duties of GAS AND WATER MANAGER within the Board's district. Salary £250 per annum.

The duties, and any further particulars, may be known from the undersigned, who will receive applications (with testimonials) up to the 3rd day of December next.

JOHN POOLE, Clerk.

Ulverston, Lancashire, Nov. 22, 1876.

GAS AND WATER MANAGER.

NOTICE is hereby given that the Millom Local Board require a working GAS AND WATER MANAGER for their district.

Applications, with salary required, and testimonials, to be sent to the undersigned up to the 3rd day of December next.

JOHN POOLE, Clerk.

Ulverston, Lancashire, Nov. 22, 1876.

THE Directors of the Wymondham Gas- light and Coke Company (Norfolk) are willing to LET their WORKS for a term of years. Annual quantity of coals carbonized about 350 to 400 tons.

For further particulars apply to ARTHUR GLASSPOOLE, Secretary, Wymondham, NORFOLK.

TO BE SOLD by Private Contract, as a going concern, the Freehold GAS-WORKS, Plant, Mains, Services, Station-Meter, and a number of Consumers Meters, at Haswell, Durham. The whole in good working order. Make about a million feet per annum, and increasing.

Apply, in first instance, to the Proprietor, J. B. SPARKE, 32, Victoria Chambers, South Parade, LEEDS.

TO BE SOLD, very cheap, as they stand, for immediate removal, four Cast-Iron PURIFIERS, 10 ft. by 5 ft., with strong wrought-iron covers, wood sieves, and lifting apparatus complete, and 8-in. hydraulic centre-valve and connexions. Also a Station-Meter in cast-iron case, with clock and tell-tale, and bye-pass valves, all complete. To pass 6000 cubic feet of gas per hour.

The above apparatus has just been thrown out of use at the Uxbridge Gas-Works, where it may be seen.

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FOR SALE, Cheap, Two 5-h.p. Cornish BOILERS, in good condition. May be seen at the Reading Gas-Works.

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TWELVE Gasholder Columns for Sale, cheap and good, about 30 ft. high by 2 ft. diameter at base, 1 ft. 6 in. at cap. Moulded caps and bases, guide-rails, and brackets complete. Suitable for gasholder 80 ft. to 100 ft. diameter.

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THE Shanklin Gas Company have for SALE the following PLANT:—

One Governor, by Bower, with 5-in. connexions, bye-pass valve, one 5-in. valve, one 4-in. valve.

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Nine 18 in. and five 15-in. Circular Mouthpieces, with lids and screws complete.

13 Ascension-Pipes, 5-in. to 4-in.

13 H-Pipes.

Apply to W. SUTHERLAND, Secretary, Shanklin, ISLE OF WIGHT.

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A 6-h.p. Patent Trunk Engine. (Beale.)
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Exhauster to pass 15,000 feet per hour. (Beale.)
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Wrought-iron Condenser, six vertical Legs, 30 ft. high, 24 in. by 6 in., with tar-boxes, dips, and syphons.
Wrought-iron Scrubber, 5 ft. diameter, 20 ft. high.
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A set of four cast-iron Purifiers, 12 ft. square by 5 ft. deep, with galvanized wrought-iron covers, lifting apparatus, four tiers of wooden sieves, 10-in. connexions and valves.

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Further particulars may be obtained on application to Mr. THORNTON ANDREWS, SWANSEA.

TENDERS FOR TAR.

THE Directors of the Londonderry Gas-light Company are prepared to receive TENDERS for the surplus TAR produced at their works for such period as may be agreed on, from the 1st of January, 1877.

Tenders to be lodged with the undersigned on or before Monday, the 11th of December next.

JOHN MACMIE, Manager and Secretary.
Gas-Works, Londonderry, Nov. 13, 1876.

ALDERSHOT LOCAL BOARD OF HEALTH.

TENDERS are hereby invited by the Board for the LIGHTING, EXTINGUISHING, REPAIRING, and KEEPING IN REPAIR THE PUBLIC LAMPS within the district of the above Local Board of Health.

Further particulars may be had on application to Mr. James Galsworthy (the Board's Surveyor), at the Office of the Board, Victoria Road, Aldershot.

Sealed tenders, endorsed "Tender for Lighting, Extinguishing, and Repairing the Public Lamps," to be sent to my Office, Victoria Road, not later than Four o'clock in the afternoon of Monday, the 4th day of December next.

The Board do not bind themselves to accept the lowest or any tender.

By order,
W. E. FOSTER, Clerk to the Board.
Victoria Road, Aldershot, Nov. 22, 1876.

BOROUGH OF BARROW-IN-FURNESS.—GAS AND WATER DEPARTMENT.

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THE Corporation are prepared to receive TENDERS for the supply of about 6000 tons of GAS COAL and 2500 tons of CANNEL, to be delivered at their works in such quantities and at such times as may be required during the Twelve months ending Dec. 31, 1877.

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Particulars and conditions of contract may be obtained on application to the Manager of the Gas and Water-Works.

Sealed tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed "Tender for the supply of Gas Coal, &c.," to be sent in to me not later than Tuesday, the 5th day of December, 1876.

The lowest or any tender not necessarily accepted.

C. F. PRESTON, Town-Clerk.
Municipal Offices, Barrow-in-Furness,
Nov. 15, 1876.

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PLUTONIC CEMENT,
For Jointing and Repairing Retorts and Ovens both in and out of Action.
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RETORT SETTINGS—giving great Economy of Fuel.
STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES.
FUEL-MACHINE, for Compressing Breeze and Tar.
WASHERS, SCRUBBERS, and PURIFIERS, that Economize Space and Cost.

N.B.—Pamphlet, with Eighteen Illustrations of the foregoing, with letterpress on the construction of Gas-Works, post free, 2s. 6d.

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GAS ENGINEERS & MANUFACTURERS,
IRONFOUNDERS AND CONTRACTORS,
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LINCOLN.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.
REFERENCES TO 500 WORKS ALREADY ERECTED.

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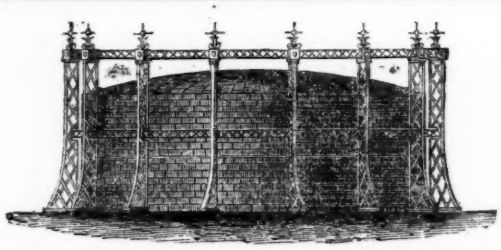

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All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

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DIBDALE FIRE-CLAY, BRICK, AND GAS-RETORT WORKS,

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Ovals . . 17 in. × 14 in., 17 in. × 15 in., 20 in. × 15 in., 21 in. × 15 in., &c.

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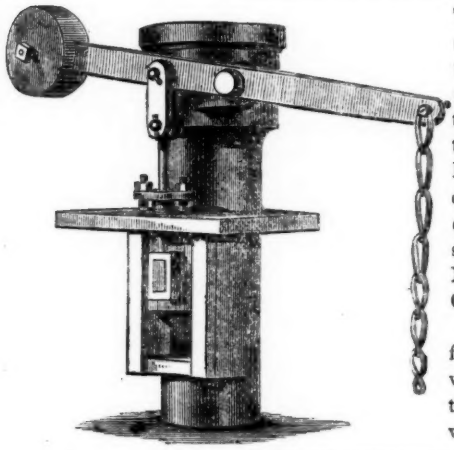
Special attention given to the execution of Export Orders.

MOORE'S PATENT DIP-PIPE.



THE advantages of this Dip will be seen from the engraving. It is thoroughly effectual in its working, removing the whole of the pressure of the hydraulic main from the retort, thus causing a great saving in gas. It is very easy of manipulation, requiring little care and attention; it cannot get out of order, and, when shut, works as an ordinary Dip-Pipe. No accumulation of carbon in retort. Can be fixed to existing H-pipes.

In ordering the Dip, the distance from top side of hydraulic main to water-level should be stated; also the Dip at which it is required to work when the valve is shut.

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To whom all communications should be addressed.

MAKERS: THE COALBROOKDALE COMPANY, SHROPSHIRE.

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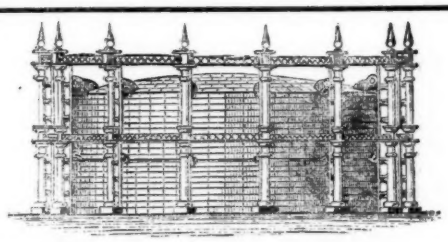

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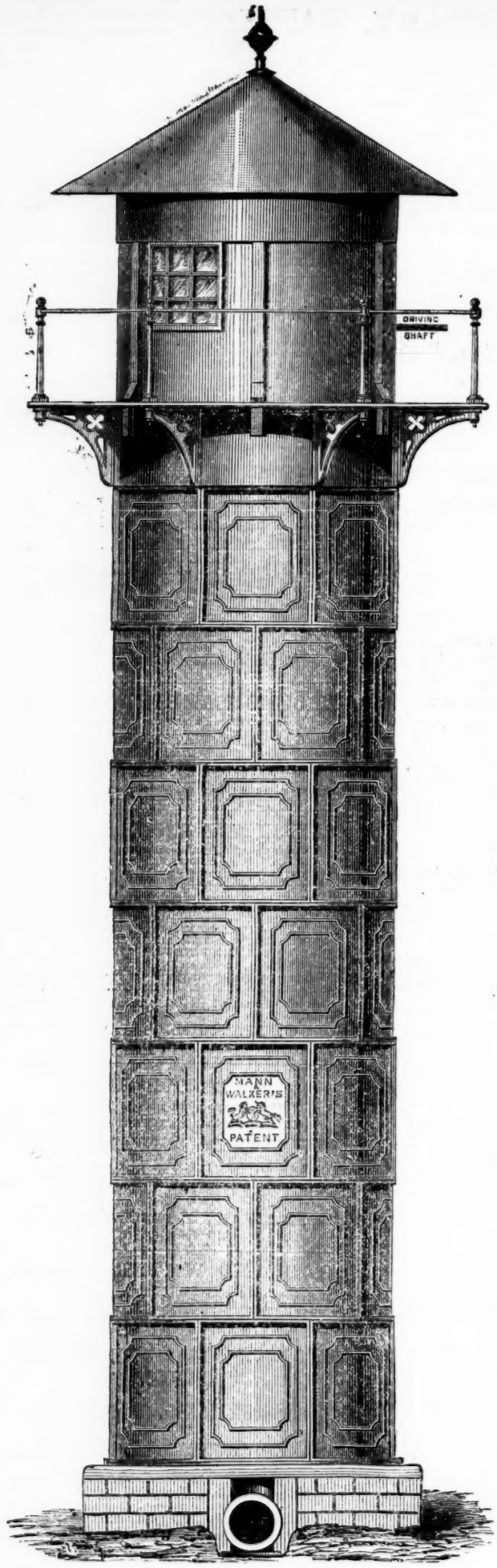

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By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

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They are, in all cases, constructed under guarantees to perfectly perform their work. They are now extensively used in the largest gas-works of London and the chief cities of Europe, the number in use exceeds **one hundred,** and their perfect efficiency and profit to a gas company have been fully established with every variety of coal used in Europe. References can be given to the largest gas-works in Europe.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

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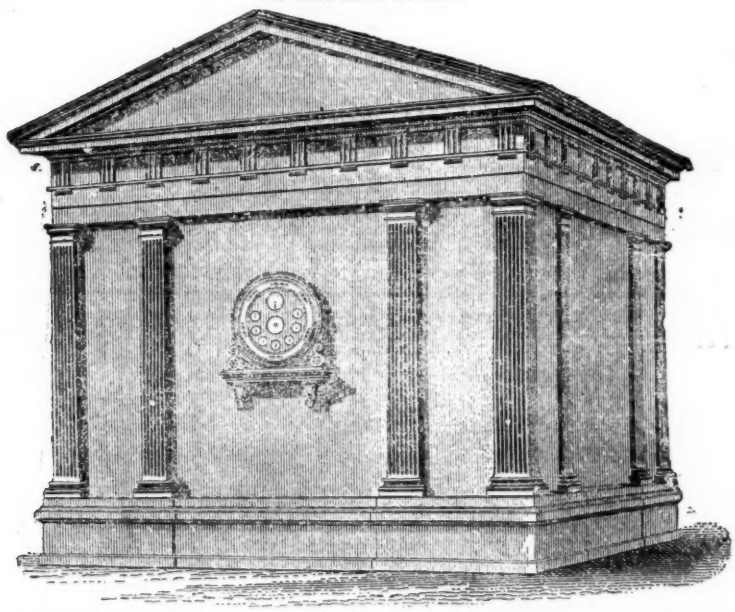

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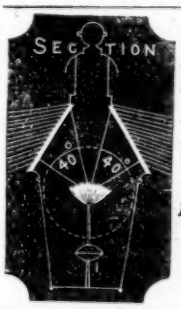

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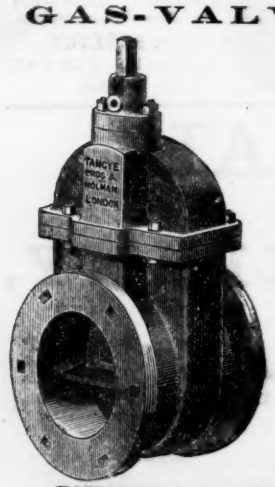

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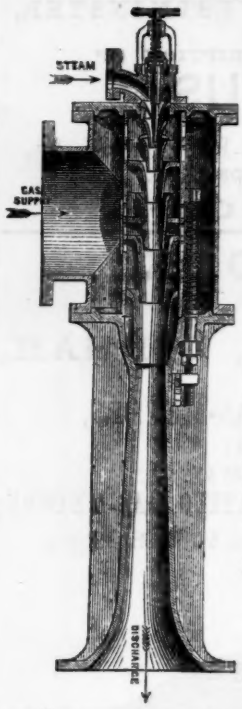

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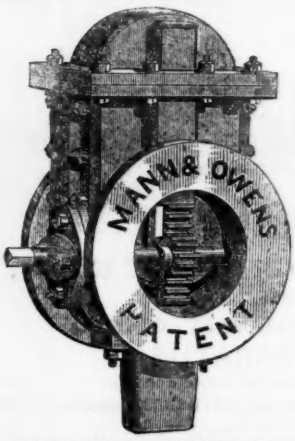
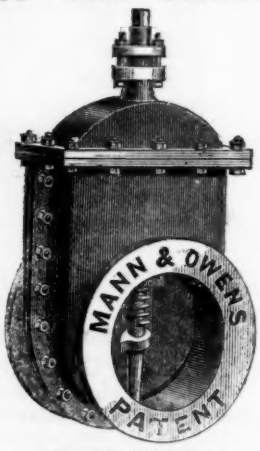


RACK AND PINION VALVE.



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The advantages of this Patent Valve over all others yet introduced are, that it is always as tight as the best wedge or spring valve, without the possibility of setting fast or becoming suddenly leaky. The surfaces not being in contact during the operation of opening or closing, leakage through wear and tear is avoided.

The Gas Engineer will not fail to see the importance of such a valve in connexion with his purifving apparatus, particularly in the case of large sizes.

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POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over 10,000 cubic feet of gas, with an illuminating power of 16 candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.
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Cubic feet of Gas yielded per ton . . . 10,050
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Yield of coke per ton of good quality . . 13½ cwts.
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This Cannel produces in actual working, in iron retorts, 9300 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.
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SOLE AGENT FOR
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"SELLARS' CEMENT"
PREVENTS WASTE OF GAS FROM RETORTS;
SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;
GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;
And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.
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REAL OLD SILKSTONE GAS COAL.
JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—
"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces 12,240 cubic feet of 16·66 candle gas."
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THORNCLIFFE IRON-WORKS AND COLLIERIES,
NEAR SHEFFIELD,
STRONGLY RECOMMEND A TRIAL OF THEIR
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Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—
(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.
Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.
These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.
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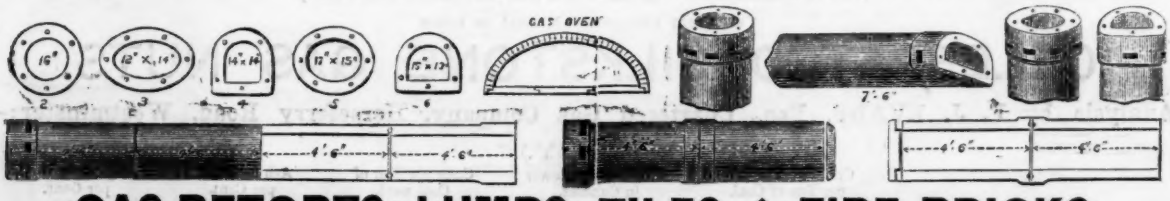

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